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REMOVAL NOTICE.

The offices of THE ELECTRICAL WORLD have been moved to more commodious and suitable quarters in the new Franklin Building, No. 9 Murray Street. Readers and friends of THE ELECTRICAL WORLD, especially those visiting New York City, are invited to call and make themselves at home in the new headquarters.

THE ELECTRICAL EXHIBITION.

Last Monday evening the President of the United States pressed a key in the White House, at Washington, and thereby officially opened the show of the Electrical Exhibition Company in New York City. This institution is far from being local in its character and interest. It is in reality a specialized exhibition, with as wide a patronage as the great general expositions of national fame. Although this is only the second exhibition, it has already gained a national interest. Electrical engineers from all parts of the country are expected to attend, an indication of this being the advertisements which neighboring hotels have sent out to the electrical fraternity in all of the large cities.

Consulting, constructing, central station and traction engineers will find a great many instructive and interesting features at this exhibition. All the largest manufacturing houses of electrical and allied interests in this country are exhibitors, and they have vied with each other in bringing out the latest and most improved types of apparatus for exhibition. The old adage that "seeing is believing" has no better application than to the apparatus here shown. Actual study of the apparatus in operation is better than any amount of reading of catalogue and testimonials. The engineer who wishes to keep in touch with the latest practice will find that a trip to New York during the month of May can be made as instructive as an extended journey to factories and scattered installations. The electrical journalist is supposed to be fairly well posted in all the latest novelties and improvements, but the writer can testify to the fact that there are surprises to him in the exhibits shown, and the average engineer can therefore expect to find much of interest.

While this pilgrimage of the technical men is what makes the show of value to the exhibitors, financial success for the management is assured by the popular interest in the "latest wonders of the age" on the part of a large portion of the enormous population resident in the metropolitan district about New York City.

A striking illustration of the possibilities of the rapid installation of heavy machinery has been shown in the preparation for the exhibition. The building to be occupied was turned over to the officers of the exposition at midnight on April 23, and between that time and the 2d of May it was necessary to put in many complete power plants and installations of the most intricate kind, including every detail from a 5-foot stack, 100 feet in height, a battery of boilers, engines, dynamos, piping, wiring, etc., to all the auxiliary apparatus and the tremendous multiplicity of small features needed to make the exhibits operative and sightly. Although the work was far from complete at the time of opening, an enormous amount of work had been done in the eight days available.

GENERAL ELECTRIC FINANCES.

Nothing novel or unexpected is contained in the annual report of the General Electric Company, which is to be found in another column. The management states frankly that the year began with fewer orders on hand than any of its predecessors, and that the company's output was consequently smaller than in previous years. Orders received since exhibit a marked increase, but this will be reflected in the shipments of the current fiscal year. In fact, the report states that the company enters upon the new year beginning February 1, 1898, with a larger list of unfilled orders on hand than ever before.

The financial results of the year just ended must, therefore, be considered in the light of the above circumstances. The total sales are given as $12,396,093 and the profit on the same as $1,499,515, comparing with sales to the amount of $12,540,993 in the preceding year. This furnishes the key to the income results, which compare with the items for the year before as follows:

Year Ending January 31.	1898	1897.	Changes.	
Gross Earnings	$12,524,938	$12,820,396	Dec.	$295,458
Expenses	10,727,692	11,207,389	Dec.	479,697
Net Earnings	$1,797,246	$1,613,007	Inc.	$184,239
Interest on debentures	333,333	431,250	Dec.	97,917
Balance	$1,463,913	$1,181,757	Inc.	$282,156
Interest, discount and dividends on securities	389,789	370,480	Inc.	19,309
Total Income	$1,853,702	$1,552,237	Inc.	$301,465
Charged off	752,221	729,535	Inc.	22,686
Balance	$1,101,481	$822,702	Inc.	$278,779
Profit, securities sold and debentures cancelled	130,371	136,956	Dec.	6,585
Reduction previous deficit	$1,231,852	$959,658	Inc.	$272,194
Previous deficit	12,957,413	13,917,071	Dec.	959,658
Present profit and loss deficit	$11,725,561	$12,957,413	Dec.	$1,231,852

On the basis of the present capitalization the net income, after charging off $752,000 to depreciation and so forth, was sufficient to exceed the 7 per cent. to which the preferred stock is entitled by a balance equal to almost exactly 2½ per cent. on the common stock. In this respect the showing is satisfactory and promises a realization of the plan to settle the 31½ per cent. of accumulated dividends on the preferred stock and wipe out the impairment of capital by reducing the stock to half its present amount of $4,252,000 preferred, and $30,460,000 common. This, it is needless to say, is the vital matter in the affairs of the company. The management was naturally nervous about formally bringing this plan before the stockholders at a time like the present, although the report states that it is intended to present it at an early date.

In this connection it may be well to sound a note of warning. The troubles of the General Electric Company were largely the result of over-capitalizing its assets. It is to be hoped that the new financial organization will not run to the other extreme. The report refers to the necessity of building a new foundry and machine shop to cost $500,000, of which amount $250,000 was provided from last year's earnings. This, however, is only a foretaste of the requirement of the business, should electrical development continue at its present pace. The report for the past year creates a strong impression that the plan now devised will lead to a resumption of dividends on the reduced capital, but in the present state of the industry there will have to be room for expansion in capital and facilities commensurate with that which may be expected in the business. It is important for the electrical enterprises of the country at large that this conspicuous example of the industry should be placed in a position not merely of prosperity, but prosperity of a permanent kind.

A NOVEL FORM OF THERMO-ELECTRIC BATTERY.

A paper on this subject was read by Mr. C. J. Reed at the meeting of the American Institute of Electrical Engineers, New York, April 27. The paper described experiments tending to show a thermo-electric E. M. F. between metals and heated electrolytes enormously greater than any other known thermo-electric action. The main experiment described and shown consisted in plunging two steel rods into a mass of fused alkali, one rod having a recess or groove turned into it in such a way as to reduce the conduction of heat and thereby render its immersed part hotter than the immersed end of the other solid rod in which the conduction and consequently the dissipation of heat to the air above was more rapid. An E. M. F., varying apparently with the difference of temperature between the two rods and also changing with the absolute temperature of the liquid, amounting at times to one volt, can be obtained by such a combination. It was argued that this was a thermo-electric action rather than an electro-chemical one, as the latter could not be consistent with the law of the conservation of energy, this argument in detail being as follows in the words of the writer of the paper:

"Admitting that the chemical affinity between hot iron and the electrolyte is undoubtedly different from that between cold iron and the electrolyte, no energy could be evolved in any form due to this differential affinity, except energy derived from the heat of the furnace, since the existence of this differential affinity depends only upon the difference in temperature. To suppose that the electrical energy of this cell is derived from chemical action involves the assumption that iron has a greater affinity than iron for oxygen, or that oxygen will select and combine with one of two similar pieces of iron while it dissociates from the other, and the further assumption that such a process will evolve energy. If this is possible, it can be possible only because of the difference in temperature, which in turn can be maintained only by a constant expenditure of heat from the furnace. Otherwise we should have an inexhaustible source of energy. If oxygen can evolve energy by leaving one piece of iron and combining with another, it may, with equal reason, leave the second and re-combine with the first, evolving an equal amount of energy, and there would be no limit to the number of such reversals, all evolving energy."

This line of reasoning was disputed in the discussion, particularly by Mr. Charles P. Steinmetz, who argued that the iron being oxidized at one temperature and reduced at another, considered in connection with the difference in specific heat between iron and oxygen and their combination, would allow of what might be called a thermo-chemical cycle, by which the heat would be absorbed and electricity finally delivered, the intermediate action being chemical. Thus the iron and the oxygen on being heated from the temperature of the cooler junction to that of the hotter would absorb more heat than would be again given out by the oxide in cooling from the temperature of the hotter junction to that of the cooler, thus allowing for the production of electric power without any violation of the law of the conservation of energy.

A Thirty-Mile Electric Railway.

The Lewiston, Brunswick & Bath Railroad is to be equipped with a novel arrangement of generating and power transmitting apparatus. Generators, to supply both direct and alternating currents simultaneously, are to be located at Brunswick, Me., the initial installation being 1000 horse-power. Direct current will be used in and about Brunswick, and the alternating current will be stepped up to 10,000 volts and transmitted to Bath and Lisbon Falls. Here it will be stepped down and changed to direct current by rotary transformers. The combined alternating and direct-current machines, as well as the rotaries, are being manufactured by the Westinghouse Electric & Manufacturing Company.

The Opening of the Electrical Exhibition.

Probably never before has Madison Square Garden witnessed a more brilliant or enthusiastic scene than the official opening of the electrical exhibition on Monday evening, May 2. The excitement over the war, instead of detracting from the interest in the show, was skillfully turned to good account by the managers by means of the popular representation of several uses of electricity in warfare.

The speaker of the evening was the Hon. Chauncey M. Depew, who began his address by reading the following telegram from the President of the United States just received over a telegraph line connected through from the White House to the speaker's gallery:

It gives me great pleasure to open the Electrical Exhibition in Greater New York, and to participate in this wonderful demonstration of the latest method of recording and publishing by means of electricity. I congratulate you upon the achievements of American genius. I am glad to know that the resources of the wonderful electrical arts have already been so far advanced in the United States that American electrical goods are welcome the world over.

WILLIAM MCKINLEY.

The following message was received by telephone from Vice-President Hobart and was recorded on the phonograph directly from the telephonic receiver:

I respond with pleasure to the invitation of the New York Electrical Society to assist in opening the Electrical Exhibition held under its auspices at Madison Square Garden, and beg to express my wishes for its success as a means of promoting further advances in the great electrical and engineering arts with which our national fame is already so proudly associated. I congratulate the citizens of the Greater New York that they have this opportunity of studying all that is latest and best in the science to which Franklin, even in the midst of patriotic duties and cares, gave his transcendent genius.

GARRETT A. HOBART.

Both messages were immediately put in type on a motor-driven type-setting machine, near the instruments, printed on a motor-driven press and distributed to the audience.

The speaker, in the course of his address, illustrated his remarks by the explosion, by electrical means, of a miniature bomb in a fountain in the centre of the hall, which was quite impressive, at least to those within range of the geyser created, and also by the firing, by means of Hertz wave transmission, of a dynamite gun. Great enthusiasm was evoked by the reading of an important piece of war news sent personally by President McKinley to the audience at the Garden.

Work on the exhibits was sufficiently advanced to make a good showing. The boilers and one steam dynamo were in operation, but current for the extensive lighting and decorative effects was obtained from the feeders of the Edison Illuminating Company, which had provided, through several services, an aggregate carrying capacity of over 200 kilowatts. None of the heavier machines on the main floor were in operation, but the incomplete exhibits had been rapidly decorated at the last moment, bringing comparative beauty and order out of the scene of chaos of the afternoon. The central chandelier, with its thirty-seven enclosed arc lamps, was in operation and was much admired, but the great electrical fountain suffered an accident immediately before the opening, which put it out of service.

The attendance was estimated at about 8,000 people, the mammoth garden and its galleries being crowded.

If the opening evening can be taken as an index of the degree of success of the exhibition, the organizers and officers, who have worked so hard for that end, have reason to be congratulated.

Students of Electrical Engineering in Germany.

According to recent statistics concerning the nine high schools of Germany, there were during the past winter 11,204 students, of which 611 are studying electrical energy, 3513 mechanical engineering, 1575 civil engineering and 1249 architecture.

An Electric Railway Across the English Channel.

A railway between England and France on rails submerged to a depth of 50 feet below low-water mark has been seriously proposed, according to the London "Electrician." The vehicles are to consist of platforms raised abouve the surface of the water, on which platforms through trains could be secured as they are upon car ferries. This is similar to the road built at the English seaside resort, Brighton.

The Sixth Annual Report of the General Electric Company.

PRESIDENT'S REPORT.

SCHENECTADY, N. Y., April 25, 1898.

To the Stockholders of the General Electric Company:

The past year witnessed a revival in business which increased rapidly in activity and volume during its latter months.

In the last annual report attention was called to the fact that your company began the year with less orders on hand than previous seasons. As a result of this, the actual output of your works has been slightly smaller than in previous years, although the orders received during the period have shown a marked increase. This increase will be reflected in the shipments of the ensuing year.

A careful scrutiny of the assets of your company, other than its patents, leads to the belief that previous values were conservatively fixed, and no changes of any significance have been necessary.

The patent account of the company has been kept at substantially the same amount on its books since the organization of the company. The question of a revaluation of patents is one to which consideration should be given at the proper time.

BUSINESS OF THE YEAR.

Gross earnings	$12,524,938.07	
Less expenses	10,727,692.02	
		$1,797,246.05
Interest and discount, and interest and dividends received on securities owned	389,789.16	
Less:		
Interest on debentures*	333,333.35	
		56,455.81
		$1,853,701.86
Deduct amounts written off:		
Sundry losses and allowances for possible losses	79,220.42	
Patents and patent expenses	333,334.68	
Inventories and consignments	89,665.76	
Reserve for extensions to factory plants	250,000.00	
	$752,220.80	
Less:		
Profit on securities sold and debentures canceled	130,371.31	
		621,849.49
Reduction of the deficit of previous years		$1,231,852.37

In addition to the purchase of $2,000,000 of debentures referred to in previous annual reports, your company has purchased during the year just ended $2,000,000, and the entire $4,000,000 have been destroyed. Since the books were closed $290,000 additional have been acquired, and are now held in the treasury of the company.

An increase is shown in the amount received from interest and dividends from securities owned. It is expected that the income from this source will still further increase from year to year, unless considerable sales of such securities should be made by the company.

The growth of your business has made it necessary to make further expenditures for additions and changes at your factories and in acquiring much additional machinery.

Plans have been prepared and contracts partially closed for a new foundry and a large and important machine shop, the largest buildings yet erected by your company.

In anticipation of the investment in the construction and equipment of these new shops, which it is estimated will cost about $500,000, the sum of $250,000 has been deducted from the profits of the past year and carried to factory reserve account.

It has been the practice of the company to write off the amounts expended for additional factory facilities. It is thought that these allowances are not more than are required to properly provide for depreciation in all your factory plants taken as a whole.

At the annual meeting of the stockholders, held four years ago, the question of reducing the company's share capital in the manner prescribed by law was referred to the directors. Since that time

*On $8,000,000 for four months and on $6,000,000 for eight months.

the matter has had the earnest attention of your board, and it is their hope that a plan will be submitted for your consideration at an early date, designed to provide for a suitable reduction of the share capital of the company, with a view to the resumption of dividends.

The patent situation has not materially changed since the last report to the stockholders. The company has secured many important patents during the year, by inventions of its engineers and experts and by purchase.

One of the Van Depoele trolley patents which had been uniformly sustained by the courts up to last summer has been adversely passed upon by the Court of Appeals for the Second Circuit. This decision was on a motion for preliminary injunction and is not final. The invention was an important contribution to the electric railway art, and no court has questioned its great merit. There is reason to believe that the technical objections to the claims of the patent, upon which was based the decision of the Appellate Court overruling that of the Circuit Court in favor of the patent, will be found upon full consideration at final hearing to be insufficient to defeat the patent. In view of the fact that nearly all of the railway companies in the country that would be likely to use the overhead trolley system are now electrically equipped, and that the third rail and underground conduit methods are being rapidly adopted for the important new enterprises, an adverse decision in this case will have but slight effect upon the business of your company.

Many other cases based upon patented inventions of great value, including a number on the overhead trolley system, are being pressed against infringers, in which early and, it is believed, favorable decisions are expected.

Your directors desire to express their appreciation of the valuable service of your admirable engineering and commercial staff, as a result of whose ingenuity and vigilance the company has more than maintained its position of pre-eminence in the varied and constantly increasing applications of electricity.

By order of the board of directors.

C. A. Coffin, President.

FIRST VICE-PRESIDENT'S REPORT

Schenectady, N. Y., April 19, 1898.

C. A. Coffin, Esq., President General Electric Company:

Sir:—I submit herewith a condensed report of the operations of the sales department for the fiscal year ending January 31, 1898:

Total sales (amount billed to customers).....	$12,396,093
Cost of goods sold, general expenses and taxes, including sundry losses and allowances for losses.....	10,896,578
Profit on sales.....	$1,499,515

From this profit should be deducted debenture interest, etc., as shown in the report of the second vice-president.

I stated in my last report that "the orders actually booked in 1896 were considerably less than the orders secured in 1895." As a result, we entered upon the last fiscal year with less unfilled orders on hand than usual. Our orders during the first six months of the year were far from satisfactory; the second six months showed a very marked increase in orders, and as we were not able to increase our output to such an extent as to fill these orders within the limits of the fiscal year, we enter upon the present year with a larger list of unfilled orders on hand than ever before. "Sales" include the total billed amounts for goods actually shipped. "Orders" include business secured, and become sales only when the material is shipped and billed. Our sales for 1897 are somewhat less than our sales for the previous year, while our orders are considerably in excess of the orders secured in 1896. The following figures are based on orders secured and not on sales:

We have received during the past year orders for 60,826-kw capacity of arc and incandescent lighting machines as against orders for the year 1896 of 57,476-kw capacity, an increase of 5.8 per cent.

Among the important lighting contracts secured during the year may be noted the equipment for the new station of the Brooklyn Edison Company and the equipment for the new station of the Boston Electric Light Company.

Orders received (money value) for railway apparatus have shown an increase of 33 1-3 per cent. over 1896.

Orders for railway generators aggregated over 60,000 kilowatts.

The average size of the railway motor has increased to 34.7 horse-power, while the average railway generator for 1897 was 484.3 horse-power, as against 356.3 horse-power in 1896.

Among the important railway contracts secured during the year may be noted the equipment of the Metropolitan Street Railway of New York City, the large motor order for the additional service of the Boston Elevated Railway (lessees of the West End Street Railway), and the contract for the substitution of electric traction for cable traction on the entire system of the Capital Traction Company, of Washington, D. C. The development of interurban electric railway service has been a marked characteristic of the past year. This is well illustrated in the Cleveland & Loraine, the Akron, Bedford & Cleveland, and the Cleveland & Eastern Roads, each of which is equipped with powerful motors operated at speeds up to and at times exceeding 60 miles per hour.

The growth of business in the class of electrical apparatus handled by the power and mining department is strikingly shown by the following comparison of orders received for various years past:

Orders for	1893	were	36	per cent.	in excess of	orders for	1892
" "	1894	"	126	"	" "	"	1893
" "	1895	"	10	"	" "	"	1894
" "	1896	"	60	"	" "	"	1895
" "	1897	"	60	"	" "	"	1896

Orders for direct current and induction motors aggregated 19,531 horse-power as against 15,171 horse-power in 1896. Orders for multiphase generators aggregated 49,902 horse-power as against 25,007 horse-power in 1896.

Total transmission lines installed in connection with G. E. apparatus 326 miles, as against 232 miles in 1896.

The supply department has handled 114,229 separate orders during the year, or forty-three for each working hour. The "orders received" in 1897 exceeded by 20 per cent. the "orders received" in 1896.

The supply stocks carried at our local offices have been decreased about 7 per cent. during the year, and of the present total, 90 per cent. consists of active supplies, a great improvement over previous years.

The orders of the foreign department have shown a gratifying increase over the orders for 1896. Several notable contracts have been placed with us by our foreign companies—the equipment of the Central London Underground Railway, and the equipment of the street railways in several European cities.

The incandescent lamp orders for the year aggregated 6,857,239, of which 6,706,624 were shipped. This is an increase of about 10 per cent. over the year 1896.

The success of the sales department is, in a great measure, due to the administrative ability and untiring energy of the department managers, and I desire to particularly commend their good work to your notice.

Respectfully submitted,

Eugene Griffin, First Vice-President.

THIRD VICE-PRESIDENT'S REPORT.

Schenectady, N. Y., April 19, 1898.

C. A. Coffin, Esq., President General Electric Company:

Sir:—I submit herewith a report on manufacturing and engineering for the fiscal year ending January 31, 1898:

The percentages added by the three factories to their raw material and labor in estimating factory costs have been found ample to cover all items of general expense, including a proper allowance for depreciation. The inventories have been taken with great care and counted and valued item by item. The stock is in excellent condition and covers only apparatus and material for which the demand is constant and active.

The press shop, mentioned in my last report as nearing completion, was finished and occupied early in the year, and its use has resulted in economies which more than justify the cost of its construction.

It was found necessary to increase our testing, assembling and shipping facilities by adding to our existing building an extension of 36,000 square feet floor space, admirably adapted to the purposes for which it was built. The main bay is served by an electric crane of 40 tons capacity, permitting the economical loading of our apparatus directly upon the cars, which enter the building by a spur direct from the tracks of the New York Central & Hudson River Railroad and the Delaware & Hudson River Railroad. This addition has enabled us to concentrate our finished stock and gives the best facilities for the economical and prompt shipment of apparatus.

We have added to our Schenectady plant about eighty-seven acres, a portion of which was covered by buildings which we are now using for manufacturing and storage purposes.

The growth of our business, together with the demand for electrical machines of increased capacity, has made inadequate our present facilities for the production of iron castings, and we are now constructing a new iron foundry containing 94,000 square feet, which should be completed during the present year.

The demands upon our engineering and drafting force have required increased facilities, which have been provided in a new drafting room, of ample size, thoroughly lighted and complete in all its appointments.

Our increased business in foreign countries has disclosed the fact that in design, cost and efficiency our machinery compares most favorably with that of European manufacturers.

Valuable data, drawings, patterns and tools, necessitated by the large amount of special apparatus which we have successfully designed and manufactured in the past, are now frequently available in the construction of new apparatus, thus reducing the cost of developing such apparatus.

Our manufacturing plants at Schenectady, Lynn and Harrison have been maintained in first-class physical condition. Labor-saving devices, special machinery and improved tools have been, as heretofore, added liberally whenever an improvement in the quality of the product or increased economy of manufacture would result.

The number of undertakings requiring machinery of large capacity and special design has increased materially during the past year. This has been due largely to the application of electricity to the operation of underground, suburban and interurban railroads, and also to the concentration of power in large units, due to the demonstrated economy of our three-phase machinery and the rotary converter mentioned in previous reports. A most notable and important installation is that of the underground Central London Railway, which we are equipping with three-phase generators, rotary converters and thirty-two large electric locomotives.

Another remarkable undertaking is that of the mammoth new station of the Metropolitan Traction Company, of New York. From this station enormous electric generators will operate, through the medium of rotary converters and other machinery of our design and manufacture, the electric street cars throughout nearly the entire Borough of Manhattan.

In my last report I called attention to the value of our rotary converter, a species of connecting link between the alternating and continuous current systems which enables existing continuous current plants to add the advantage of alternating current generation and economical transmission to the simplicity and effectiveness of the continuous current distribution. The economies which thus result from the substitution of a single large alternating current power station for a number of small stations is well illustrated in a notable installation of such apparatus made during the past year by the Brooklyn Edison Company, using our three-phase generators, rotary converters, synchronous motors and other appliances.

The number of long distance transmission plants has greatly increased during the past year, so that we have now a total generating capacity in such plants of over 100,000 horse-power, and among these some twenty installations are operating at potentials of over 10,000 volts and transmitting a total of some 50,000 horse-power to distances varying from 10 to 40 miles. The 5000-hp plant at Ogden, Utah, has been in operation for nearly a year, transmitting power to Salt Lake City, a distance of 36½ miles, at a potential of 16,000 volts. We have now under construction apparatus intended for the transmission of over 4000 horse-power from a distant water power 80 miles to the city of Los Angeles, Cal., at a pressure of 33,000 volts. The St. Anthony Falls plant, mentioned in my last report, has been completed and is now in regular operation, furnishing power to the street railways of Minneapolis and St. Paul, Minn.

In the city of New Orleans, La., we shall soon have in operation a novel plant of some 4000 horse-power, which will be used to operate pumps for the drainage of the city. Three-phase machinery will be employed.

The driving of all machinery in cotton mills and factories by electric motors is increasing rapidly, even where the original source of power is a steam engine located in or near the mill or factory itself.

The United States Navy is adopting the electric drive in place of steam or hydraulic machinery for ventilating, pumping and hoisting on shipboard and for lowering and elevating guns and for turning turrets on the warships. This is in addition to the recognized use of electricity for lighting and small power work.

We shall soon be operating our Schenectady works from a distant water power. We have contracted for a supply of 2000 horse-power from the falls of the Hudson River at Mechanicsville, 19 miles from Schenectady. A novel feature of this transmission is that the generators, each of 1000 horse-power, have been constructed by us to produce directly a pressure of 12,000 volts, thus saving the cost of the usual intermediate step-up transformers.

Our older transmission plants, such as Portland, Ore., and Fresno, Cal., operated with great success and have largely increased their capacity, demonstrating the advantages of our system and apparatus in the electrical utilization of water powers.

There has been a great improvement in the efficiency and quality of our numerous small articles of manufacture, such as arc lamps, transformers, meters, switchboards, etc., many features of novelty and value having been developed by our engineers. Our business in this line has shown a gratifying increase.

We have continued to protect our new and important engineering designs as far as possible by application for letters patent.

The efficient work of the factory managers and the unequaled ingenuity, skill and industry of our engineers are worthy of special commendation. Respectfully submitted,

E. W. RICE, JR., Third Vice-President.

The balance sheets for four years compare as follows:

Assets:

	1898.	1897.	1896.	1895.
Patents, franchises	$8,000,000	$8,000,000	$8,000,000	$8,159,264
Factory plants	3,400,002	3,400,002	3,468,000	3,000,000
Real estate	586,529	643,016	453,584	423,783
Stocks and bonds	7,455,873	8,545,796	5,479,332	5,079,012
Accounts receivable	4,537,300	4,578,601	6,584,123	6,550,499
Inventories	3,860,553	4,034,753	4,219,883	3,859,668
Work in progress	283,832	517,866	961,386	757,087
Cash	1,425,875	703,484	879,685	404,236
Profit and loss	11,725,561	12,957,413	13,917,071	14,794,716
Sundry	....	....	....	27,989
Total	$41,275,525	$43,380,931	$43,963,069	$43,956,258
Liabilities:				
Common stock	$30,460,000	$30,460,000	$30,460,000	$30,460,000
Preferred stock	4,252,000	4,252,000	4,252,000	4,252,000
Debentures	6,000,000	8,000,000	8,750,000	8,750,000
Accrued interest	30,000	66,667	72,916	72,916
Accounts payable	263,525	402,265	428,153	421,341
Reserve for extension	250,0000	....	....	....
Mortgage on Edison building	....	*200,000	....	....
Total	$41,275,525	$43,380,931	$43,963,069	$43,956,258

*Paid off February 26, 1897.

The Economy Test of a Central Station.

A paper on this subject was presented at the meeting of the American Institute of Electrical Engineers, in New York, on April 27, by Prof. W. E. Goldsborough, of Purdue University. The station tested was the West Pratt Street station of the Edison Electric Illuminating Company, of Baltimore, Md.

While the station is not by any means a model up-to-date one, it is perhaps representative of the average lighting station of gradual growth and moderate size. The engine equipment, for example, consists of one 600-hp horizontal cross-compound Ball & Wood engine, one high-speed Russell simple engine of 170 horse-power, one of 125 horse-power, one 300-hp tandem-compound Ideal engine, one 300-hp cross-compound Ball & Wood engine, two 145-hp Buckeye engines, and one 300-hp Ide engine. The generators are series arc and 1000-volt alternating machines of as wide a range of makes and sizes, all being belted machines.

The tests were most complete, and some of their results are of interest, in that they show the low economy to be expected of such a heterogeneous equipment.

The boiler tests showed that the equivalent water evaporated per pound of combustible from and at 212° Fahr. varied from 6.83 pounds to 12 pounds, averaging between 8 and 9 pounds. The all-day efficiency of the plant or ratio of the electrical horse-power at the switchboard to the indicated horse-power at the engines was found to be about 68 per cent., which is commented upon as "excellent, in showing that the station is operated far more efficiently than could be expected when the numerous drawbacks which have to be contended with are remembered." The electrical output per pound of coal is given for one test as 150.5 watt hours, and for another test as 157.3. This figure is compared with the data given in the report of the committee of the National Electric Light Association in 1896, in which the average efficiency of eighty-one stations, using coal as fuel, was given as 108 watt hours per pound of coal.

The Electric Lighting Plant of the University of Michigan.

BY PROF. HENRY S. CARHART.

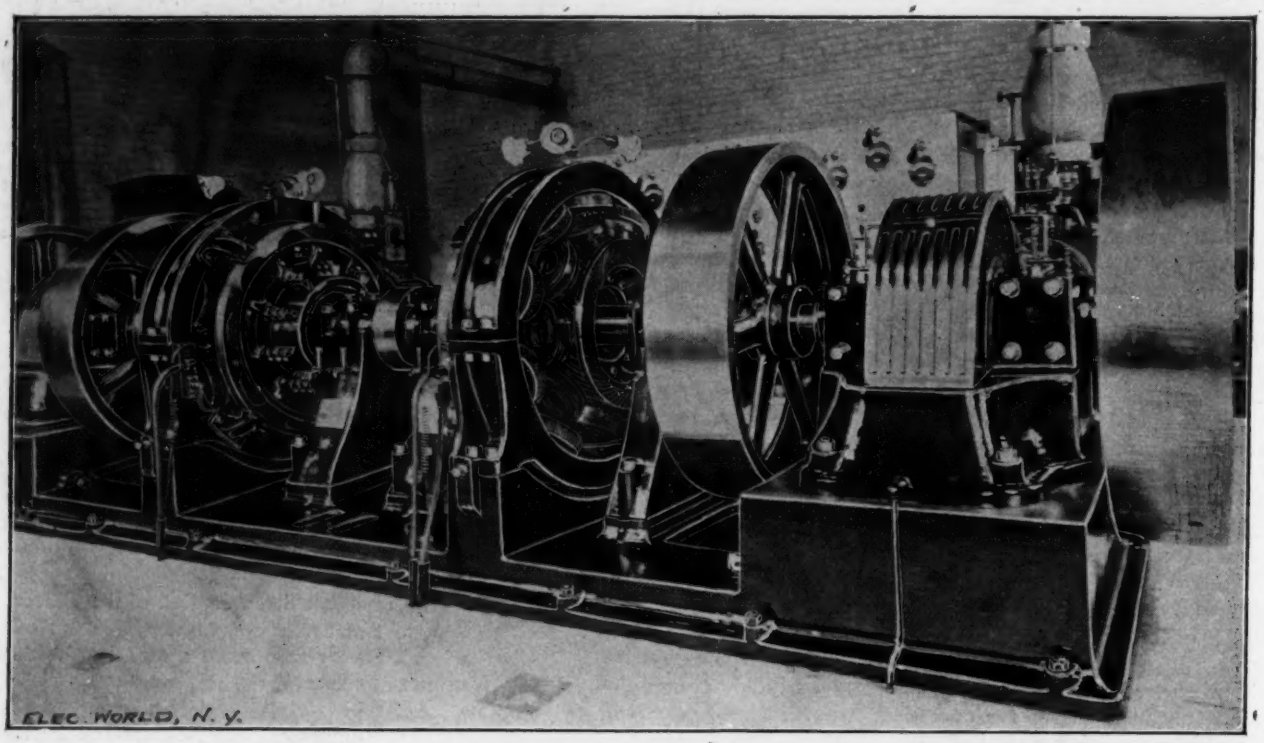
THE electric lighting and power plant of the University of Michigan presents several features of interest which justify a brief description. The major part of it has been in operation since the middle of November; the auxiliary plant at the university hospitals has, however, only just been completed.

The main plant is on the campus in a wing of the boiler house, from which sixteen buildings are heated. It consists of two 15 x 14 McEwen engines, connected by means of the Arnold system to two 75-kw Thompson-Ryan dynamos. By the Arnold system either dynamo or both of them may be run from either engine. One of the advantages of this arrangement is that the dynamos can be tested by purely electrical methods, since they can very readily disconnected from the engine.

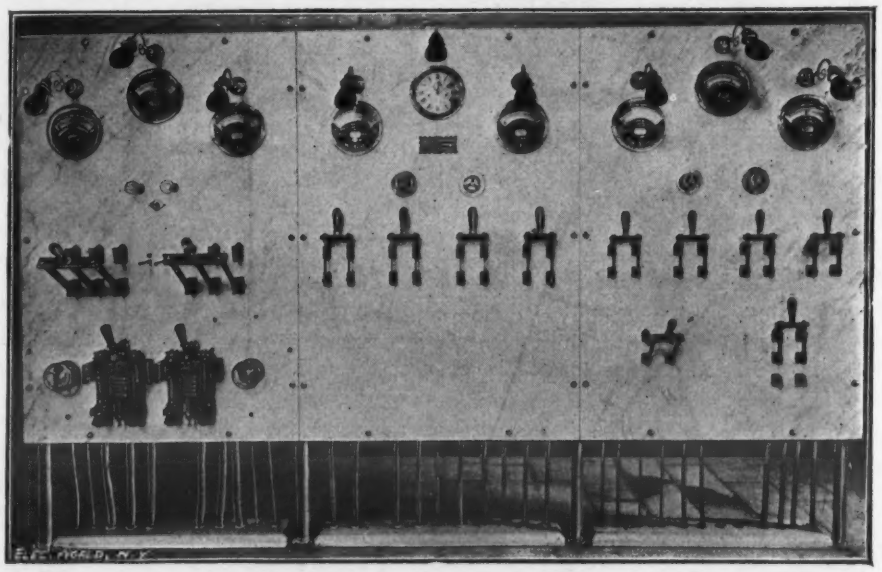
In the nineteen buildings on the campus lighted by this plant are 4000 incandescent lamps and twenty-three enclosed arcs. There are nine more of the latter on the grounds. The observatory and the hospitals have 600 more incandescents. Another large building is now under construction, and this will bring the total number of incandescent lamps up to 5000.

The system is two-wire 220 volts direct. It was adopted after mature deliberation, despite the lower efficiency of the 220 as compared with the 110-volt lamp. The two prevailing reasons were the great distance of some of the buildings from the power house, and the desirability of employing the same generators for power and lighting. The steam for heating the buildings is carried through a brick tunnel, 5 feet 6 inches x 6 feet 6 inches, extending from the power house round near or under all the buildings and back to the power house again, a distance of 2800 feet. The largest buildings are at the greatest distance. The lighting mains had to be carried through this same tunnel. Hence the cost of the copper for a 110-volt system was almost prohibitive. It was also desirable to replace several small steam engines by electric motors in order to secure centralization of power. Other motors were needed at a considerable distance from the station. To these considerations must be added the fact that the observatory and the hospitals are nearly three-quarters of a mile from the power house, and economy dictates that these should be lighted from the main plant. It is much easier to do this with 220 volts than with 110.

To secure uniform pressure throughout the distribution on the campus the following plan was adopted: A pair of No. 000 mains is carried entirely around through the tunnel, forming two complete circles. To four points of these, as centres of the heaviest loads, are connected four pairs of feeders. Each pair runs directly from the bus bars through a switch on the switchboard. The positive and negative cables are supported on opposite sides of the tunnel between special porcelain knobs. No greater difference of pressure than two volts has ever been observed at the ends of these feeders. Service wires run through fused switches directly from the mains to the several buildings. Buildings not located over the tunnel are reached by braided caoutchouc cables drawn into galvanized iron pipes. There is no insulation in the pipes. A few of the service cables are from 150 to 200 feet long. Thus far not the



View of Generating Plant.



Front of Switchboard.

slightest trouble has been experienced, and not a single fuse has gone in the tunnel, either on feeders or service wires.

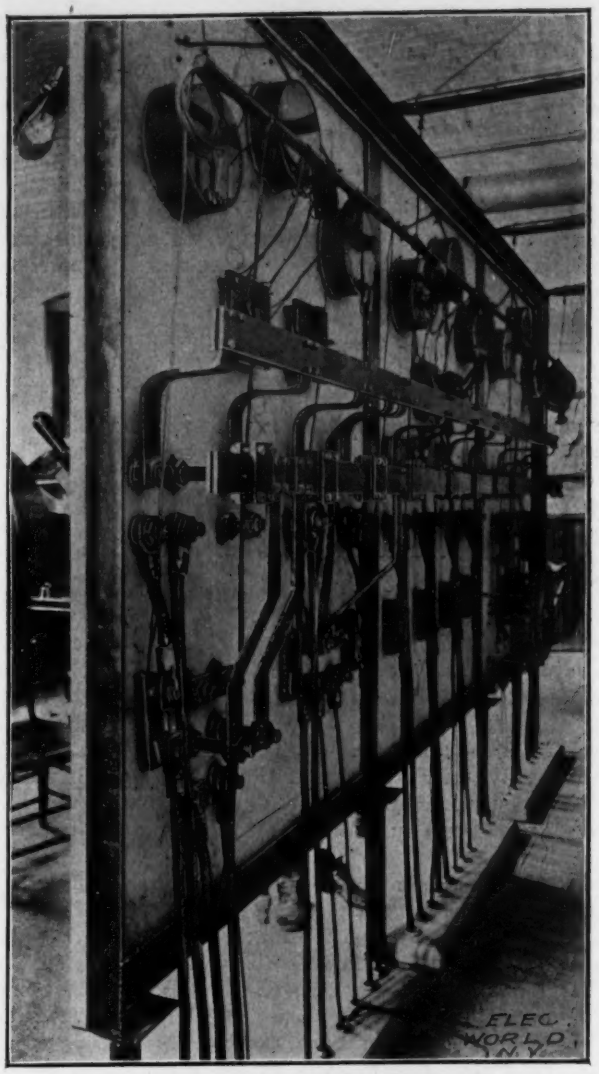
The buildings are all wired on the closet system. The closets have slate backs and are lined with heavy asbestos board. The fuses are all of extra length. No porcelain fuse blocks are used at these centres, and there are no fuses in the fixtures, except in porcelain rosettes and extension attachments. Single-pole snap switches and the best grade of General Electric sockets are used throughout. Special precautions have been taken to secure safety by the use of nothing but the best insulation, abundance of flexible tubing, and lamp cord with double rubber insulation.

Current is carried to the hospitals by means of No. 000 cables a distance of 3800 feet. To compensate for the drop in potential a series-wound "booster," designed to raise the potential 50 volts at full load, is included in the circuit. The motor and generator of the set are directly connected together on the same base. They were made to order by the Excelsior Electric Company. Adjustment of the pressure is secured by two methods, one by shunting the field of the generator, and the other by a rheostat in the field of the motor. After 10:30 at night only a small current is needed on the campus, while light must be available all night at the hospitals. Hence a 25-kw Westinghouse generator, directly connected to a Russell 9 x 12 engine, has been installed in the boiler-house at the hospitals. It runs at 300 r. p. m., the larger engines running at 250. After shutting down the main plant at night, the smaller one supplies the lights at the hospitals, as well as the small current needed on the campus. The small generator serves also as a reserve and as a safeguard in case of accident at the main plant or on the lines. The two power-houses are connected by a private telephone line. Pressure wires also are carried back from the hospitals to the campus switchboard.

The switchboards are of marble, supported on wrought iron frames. They are furnished with Weston instruments, round pattern, and set flush with the marble. Each generator is protected by an I. T. E. automatic circuit breaker. There are no fuses on the boards. The large one, consisting of three panels, was made by the Western Electric Company, after plans and specifications furnished them; the small one by Bissell & Co., Toledo. All the switches on both boards were made by the Western Electric Company.

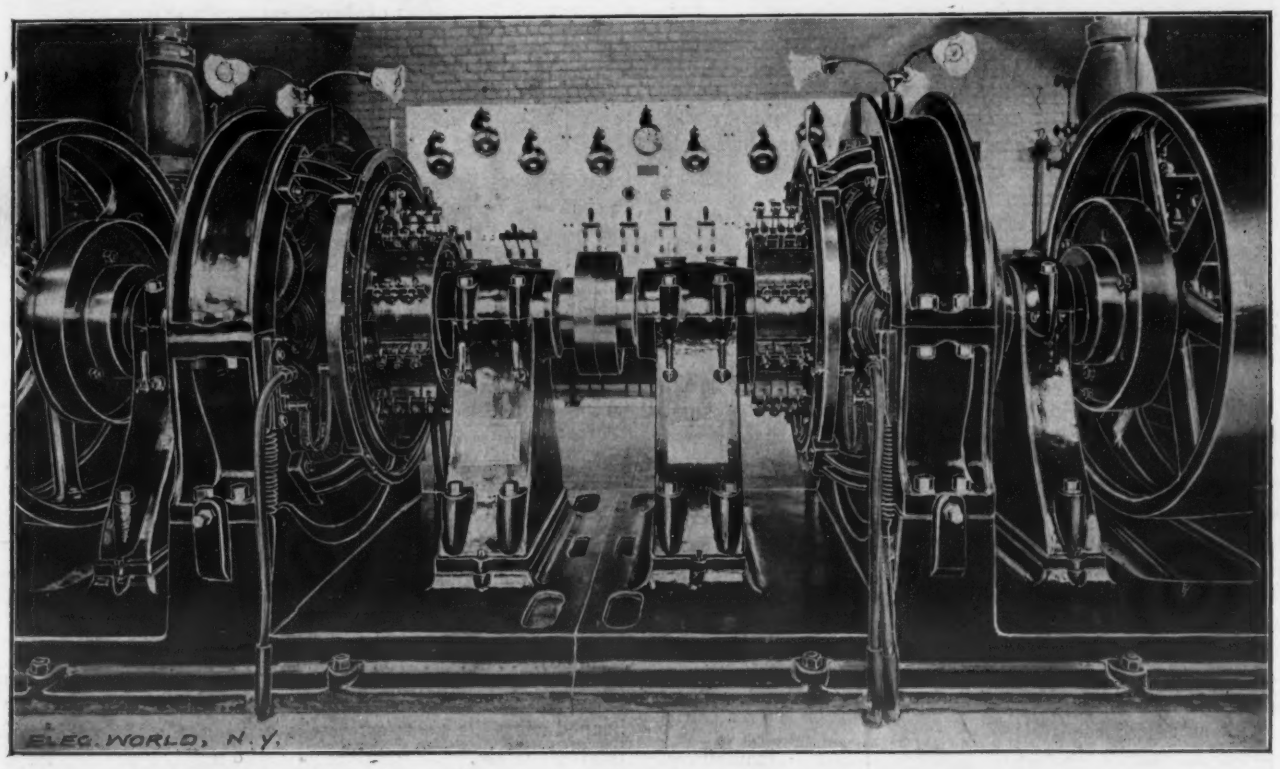
Another interesting feature is that all the engines exhaust directly into the large pipes of the heating system. Hence single-expansion non-condensing engines are used. The back pressure runs from 1 to 5 pounds. Great economy is secured by this arrangement and it works to entire satisfaction.

Edison 220-volt lamps are employed throughout. Most of them are 4-watt lamps; the last lot received are 3½ watt, made to order.



BACK OF SWITCHBOARD.

The test on them is now in progress, and the present indications are that they will be adopted. Occasionally a lamp short-circuits when its filament fails. The only result is the blowing of the fuse at the centre, but this is readily replaced. It occurs only rarely. Some of these 4-watt lamps have burned for five months continu-



DYNAMOS SHOWING COUPLING ARRANGEMENTS.

ously, except Sundays, and ten hours a day. They are not blackened, and to the eye do not appear to have appreciably deteriorated. In other words, they have already lived twice the allotted life of a good and useful incandescent lamp.

Thus far the day load is rather small, though ten motors, ranging from 1 to 50 horse-power, are in daily use. More are to be added. These run lathes, mammoth organ bellows, fans for ventilation requiring from 2 to 10 horse-power each, a saw and a planer in the carpenter shop, and the dynamos in the laboratory of electrical engineering. For this latter purpose a 2½ and a 50 horse-power motor are employed. They are supplied with current by special cables running directly from the bus bars at the switchboard.

The plant is running without a hitch of any kind, and the indications thus far are entirely favorable to a 220-volt system for such an installation. It was designed by the engineering department of the university, and the work of installing it and of wiring the buildings has been done by students and recent graduates of the same department.

Cleaning the Globes of Enclosed Arc Lamps.

BY J. H. HALLBERG.

The trimming and cleaning of the inner globes on enclosed arc lamps is of the utmost importance, as the efficiency and candle power depend, to a large extent, on the transparency of the inner globes.

It will be found that most of them are covered inside with a gray-white dust or film, which comes off if the globe is washed in clean water; but some, even after they are washed in water, show a brown-black stain around the top of the globe which apparently will not come off, no matter how much it is washed; in fact, it appears as though it were a natural color in the glass itself.

This is due to several causes; the most common is the impurity of the carbons, which contain too much metallic material; another is too great a length of the lower carbon, which brings the arc too near the neck of the inner globe; or the cause may be too much current flowing across the arc, especially during the few minutes after trimming the lamp with new carbons, this causing an excessive flame that gets in contact with the globe and in that way stains it.

There is to my knowledge only one way to clean a globe in this condition, and that is by dipping the burned part in hydrofluoric acid. This acid is very dangerous to handle, and much care should be exercised when it is used. As this acid will eat through most every material except lead and wax, it must be kept in a jar of either of those materials. I prefer lead, as the acid gets warm when when it acts on the glass, and I have seen cases where the wax melted and let the acid run out.

For this use a round lead vessel about 6 inches high x 3½ inches in inside diameter may be made from an ordinary lead pipe of that size by cutting it off, setting it in clay or something similar, and pouring in melted lead so as to form a base about one-half-inch thick. It should be burned to the pipe with a tight joint. Solder cannot be used, as the acid eats the solder. Enough hydrofluoric acid should be put in this lead vessel to cover all but one-half-inch of the inner globe when it is inserted. The acid is sold in special prepared wax bottles and care must be taken in handling them, especially in warm places. If any acid gets on the hands, it is well to wash them in water at once and apply pulverized soda or something similar.

For this cleaning a place should be chosen where there is draught to carry off the fumes and if possible where there is running water. If the latter cannot be obtained, two large tubs of clean water may be substituted. Boxes, with perforated bottom, spaced off for about twenty-five globes each, should also be provided. With rubber gloves dip the part of globe that is burned in the acid (this immersion will only require about one or two seconds in ordinary cases), then give it a liberal bath in the first tub of water; wipe off with a rag the light white film on the globe, and then dip in the second tub of water. After this, place it in the box with the perforated bottom. After this box is full, remove it to some warm place, as the top of a radiator, steam-pipe, or boiler, and after an hour the globes will be as good as new, although some may need a little cleaning with a rag.

Some people advise, in place of using the acid as described above, the use of ten parts of water to one part of acid; this method requires at least ten minutes immersion, and if several globes are in the bath at once, the chance of breakage is increased 50 per cent.

The above suggestions may be old to many readers, but as I was requested to drite something on this subject, I presume some one may be benefited by this article.

War Notes.

The following are some interesting notes concerning the electrical features of the Government's hasty preparations for war. They are taken from the daily press, and owing to the attempts of those concerned to avoid publicity they cannot always be verified.

ELECTRIC LIGHTING ON THE LONG ISLAND COAST.

The residents of Southampton, L. I., are afraid that their searchlights will attract the fire of a hostile fleet, if such comes along, and have petitioned the trustees to extinguish the lights during the war.

EXPERT SERVICES IN CABLE LAYING.

Prof. W. L. Robb, of Trinity College, Hartford, Conn., has been called to New London by the authorities in charge of the defense of Long Island Sound, presumably for consultation in the placing of mines and electric circuits for operating the same in the Sound.

COAST COMMUNICATION.

The Southern New England Telephone Company has stretched a set of private wires for the United States Government to run between the main circuits and many exposed points on the Sound. The islands of the Sound will be connected with some of these lines by submarine cables.

PRIVATE WIRES TO THE PRESIDENT'S WAR OFFICE.

A room in the White House is being fitted up as a war office for the personal convenience of the President. Long distance telephones, telegraph lines and special wires from the Capitol, the executive departments and from other points whence war news is apt to come are being provided.

DARKNESS AT THE HARBOR ENTRANCE.

For the first time in thirty-four years every lighthouse, range light and electric buoy in the entrance to New York Harbor, with one or two exceptions, was extinguished on the night of April 28. Two lighthouse tenders were on watch, one at the inner end and the other at the outer end of the lower bay, to warn craft that this part of the harbor was dangerous and practically impassable in the darkness.

ELECTRICIANS IN THE NAVY.

Enlistments for the position of electrician on board warships are provided for in the naval personnel bill, these electricians being of the grade of machinists or assistants to the steam engineers. Their enlistment is for a term of three years and the men must be in sound physical condition, pass an elementary examination, and show familiarity and training in the work. There are three grades, the pay ranging from $35 to $50.

PATRIOTIC AND OTHERWISE.

The Edison Electric Illuminating Company, of New York, has offered its employees who may enlist in the army or navy their salaries during service, provided the absence does not extend beyond one year, and their re-engagement on their return. It is stated, on the other hand, that the Missouri Edison Electric Company, of St. Louis, has notified its employees that any man who enlists may consider himself permanently discharged.

X-RAYS FOR THE WOUNDED.

A portable X-ray apparatus, intended for use in the Cuban campaign, has been designed by Prof. R. A. Fessenden, of the Western University of Pennsylvania. The new machine is said to be about the size of a Webster's unabridged dictionary and weighs but 25 pounds. It includes a dynamo and can be driven by a small gasoline motor or a gas turbine. The outfit is said to be sufficiently powerful to send enough rays through the body to illuminate clearly the fluoroscope.

Mr. Mordey's Visit to America.

Mr. W. M. Mordey, the designer of the dynamos and other electrical apparatus bearing his name and widely used in England, has been during the past few weeks visiting places in this country of interest to electrical engineers, and studying the latest American developments.

The Electrical Equipment of the Watervliet Arsenal.

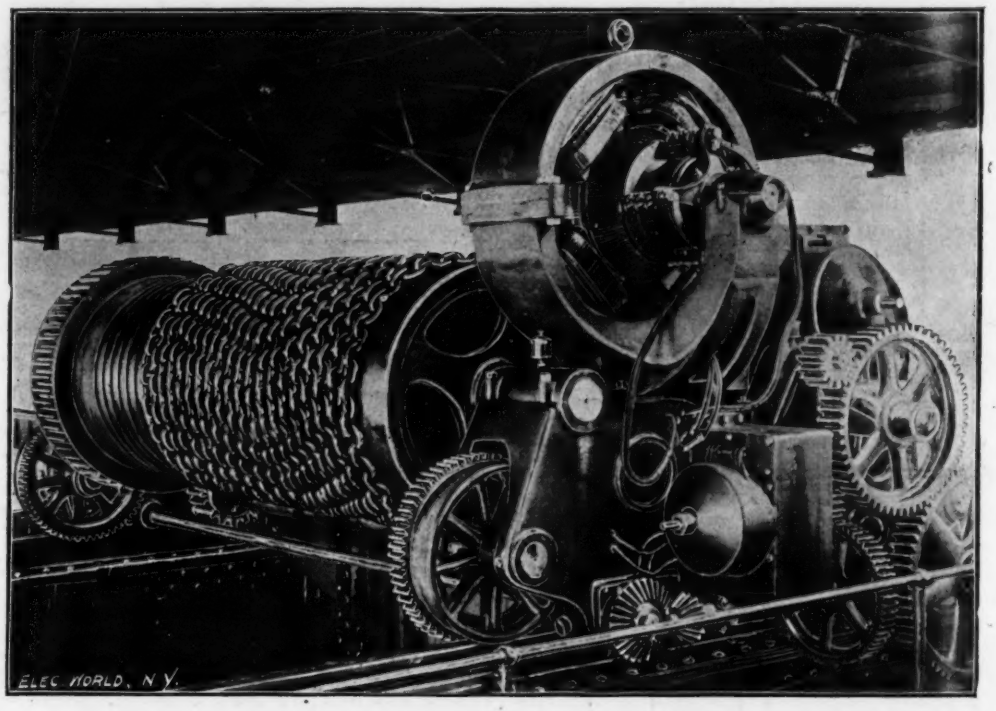
The mammoth gunshops of the United States Government at Watervliet, N. Y., are now being rushed night and day on the completion of a large number of 8-inch, 10-inch and 12-inch built-up guns, and the preliminary work for a number of 16-inch guns, the latter being the largest ever built in the world. Two ten-hour shifts of men are at work seven days in the week.

The current for lighting the shops and, in fact, the whole of the yard, is supplied by two independent power plants, duplicates of each other, the machines for which were installed by the E. G. Bernard Company, Troy, N. Y. Each of these plants consists of two 100-kw bipolar 250-volt generators, worked either singly or in multiple with each other on 250-volt circuits. One plant is belt-driven from water wheels, in what are known as the lower shops, the other being belt-driven from the main engines of the mammoth gunshop. The prime movers of either shop in case of emergency may be shut down, and the shafting and machinery of the adjoining shops motor driven up to the capacity of the machines by power derived from the other plant, the possibility of effectively doing this being the reason for the adoption of 250-volt dynamos instead of 125-volt, on the three-wire system, as offered by the competitors of the company mentioned above.

For obtaining a balance on the lighting circuits, two small bipolar 125-volt equalizers of about 15 horse-power each are coupled together and connected in series across the mains, one such pair being installed in each dynamo room. These equalizers are only used when the lighting circuits are on.

The same generators supply current to the crane equipment of the gunshop. This shop is by far the largest in this country, and is divided into one main and two side aisles, almost a quarter of a mile in length.

An idea of the magnitude of the work undertaken here can be obtained from the fact that the cost of the main gun plant is over $5,000,000. The north end of this shop is served by two mechanically driven cranes fitted with the usual square shafts, the south end being fitted with two electrically driven cranes. The heavier of these has a capacity of 120 tons and is operated by one motor of about 80-kw capacity. The later and newer crane of 60-tons' capacity is driven by four motors. On the 60-ton crane, one motor drives the bridge longitudinally up and down the shop; another drives the trolley laterally across the bridge and shop; another, located on the trolley, operates the auxiliary 15-ton hoist, and the fourth operates the main 60-ton hoist.



TROLLEY OF FOUR-MOTOR CRANE AT WATERVLIET ARSENAL.

The original main hoisting motor having been found to be too small for the heavy load and the considerable friction of the powerful reduction train, a heavier motor, shown at the top of the accompanying illustration, has been supplied by the E. G. Bernard Company. This is a four-pole machine, with cast steel yoke and laminated steel "cast-in" pole pieces, capable of delivering about 75 horse-power when running at 600 revolutions per minute. The machine is series wound, with a small "teaser" shunt-winding to prevent its running away and to give an initial field excitation. The motor is controlled from the operating platform under one end of the crane bridge. The motor works both on hoisting and lowering, the speed being controlled in the former case purely by a variable resistance in the armature circuit, and in the latter case by a combination of resistance and the use of a magnetic brake, the pressure of which can be adjusted by resistances inserted by the same controlling lever that controls the motor rheostat. In this way a slow speed and perfect control is obtained, no matter what the downward pull of the load may be. The casting of the lower half of the field ring of the motor to fit into its cramped position on the crane was no easy task, but was successfully accomplished after four castings had been lost and the steel works had refused to try again.

Power is supplied to the cranes by a row of trolley wires laid loosely along on top of the main supports and resting normally on insulators. Under-running trolley slides pick up these wires and raise them above the insulators as the crane comes along. The wires from the controlling platform to the trolley (eleven in number) are stretched along the inner sides of the bridge girders, the contacts connected to the trolley bearing upon them. These cranes are used for handling the heavy guns and the mammoth machines used in constructing them and also to manipulate the loads in the furnace and assembling or shrinkage pit in the centre of the shop. Here the jackets of the big guns are raised to the proper heat in a furnace, beside which the main forging of the gun is placed vertically on its breech. The jacket is lifted out by the crane and lowered down, while hot, over the central tube, on to which it shrinks tightly in cooling. The latter process is hastened by streams of water directed at the hot jacket from all sides. The raising and lowering of these jackets is an operation requiring extreme delicacy in the control of the cranes. It was difficult to obtain this absolute control with a small high-speed motor and an ordinary starting rheostat, but with the large low-speed motor and the special controller, also built by the E. G. Bernard Company, the work is handled with great accuracy.

The lighting system is quite extensive. There are about 200 50-cp outdoor lights, beside the following buildings: large gun factory, small gun factory, cabinet and carpenter shop, machine shop where shells are made and general repairs are attended to, iron foundry, bronze foundry, blacksmith shop, ordnance store houses, quartermaster's stores, hospital, barracks, married soldiers' cottages, non-commissioned officers' dwellings and eight officers' residences. Colonel Mordecai is commanding officer, Major Butler paymaster, Lieutenant Burr in charge of the gunshops, and Alfred Christensen is master mechanic.

The three new lathes they have just installed are the largest ever made in this country, and their cost, set in position, of over $50,000 each will give the reader some idea of the magnitude of the shops, as $50,000 will start quite a machine shop in itself. The next size smaller lathe, of which they are twenty or more, costs about $30,000 each. The large machines are at work on the 16-inch guns, which will weigh 120 tons each, the heaviest ordnance in the world.

Electric Power from the Cataracts of the Nile.

According to the London "Electrical Engineer," Prof. George Forbes has been commissioned to draw up a report to the Government on the possibilities of using the power of the Nile cataracts, the work to be undertaken in connection with the proposed storage reservoirs. It is proposed to use the power for pumping and for the wants of the cultivators.

Sectional Conductor Electric Railways—II.

BY GEORGE T. HANCHETT.

In Fig. 21 is shown a good example of the seventh class. Only the automatic device is depicted. Two studs as shown are carried by the car, and travel in a groove or slot in the trackway. The forward stud engages with one of the points of the four-armed star and turns it one-quarter revolution, switching the current on, and it remains on until the stud on the rear of the car engages with the next point and switches it off again.

Of the collapsible tube type sectional conductors with mechanical closure, three examples will suffice. The first is shown in longitudinal and transverse section in Fig. 22. A wheel presses upon the upper stud and forces it down, bending the flexible walls and making contact with the live stud within the tube. Such a design would probably be required to be made of rubber, and on that account would be impractical. Another type is shown in Fig. 23, in which metal flexible walls are employed. The section of the tube is similar to that of an elliptic spring, and when put under compression flattens out in a similar way. A live stud or wire is carried in the centre of the tube, and the sectional conductors are pressed down upon it by the collecting shoe. A third example, which appears to be more or less practicable, consists in mounting the third rail upon two rubber strips at either side as shown in Fig. 24. Considerable pressure is required to depress the rail sufficiently to make contact with the stud, and if a considerable portion of the weight of the car could be thrown upon the collecting device, it might be that such a system could be used in places where heavy teaming was not permitted. Rubber strips would deteriorate and ultimately allow contact to be made with ordinary weights.

There is still one other class of mechanical closure which has not been mentioned, because it is included in all of the seven. This consists in the use of an electromagnet in connection with mechanical devices to make and break contact, or to accomplish interconnection without the use of moving members between the boxes.

Inasmuch as several devices have been described which partake of this feature, one example will be sufficient; it is depicted in Fig. 25. The approaching trolley lifts the trolley wire and tilts the casing supporting it upon the pivot shown, and the two balls roll down against the live stud and make contact. After the trolley has passed the casing tilts back into its normal position, but as current is being drawn from it the magnetic coil holds the balls, which are of iron or steel, in their position until the trolley leaves the section, when they will fall back to their normal position by gravity. This device operates absolutely without arcing, because the magnet will not let the balls fall until all current in the wire ceases, at which time there will be no arc. This device of using a coil in series with the section for holding the automatic switch closed until all demand for current upon it has ceased is used to a considerable extent in other devices to avoid arcing, and is a very effective one.

A second great class of sectional conductor railway systems comprises those which operate the automatic devices in the trackway wholly or partly by means of magnets carried by the cars. The simplest device for this purpose which can be operated by external magnets consists of a short, movable piece which, when attracted by the magnet makes contact, and when its influence is removed falls by reason of gravity and opens circuit again.

Such automatic devices as this are usually short in their linear extent on the trackway, and hence the attracting force must by some means be continuously applied to hold the device closed while the car is passing. This may be done in a number of ways. One of the most frequent methods is to use what might be called a magnetic skate on the car; that is, an elongated magnetic surface which is equal in length to the car, and will, therefore, always be over the automatic device in the roadway, holding it closed as long as the car is over it. Such a device is shown in Figs. 26 and 27, in which

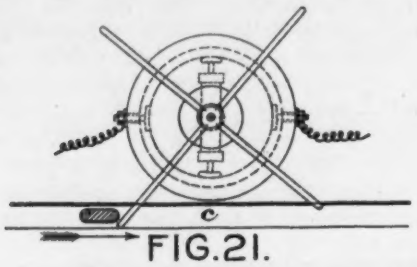


FIG. 21.

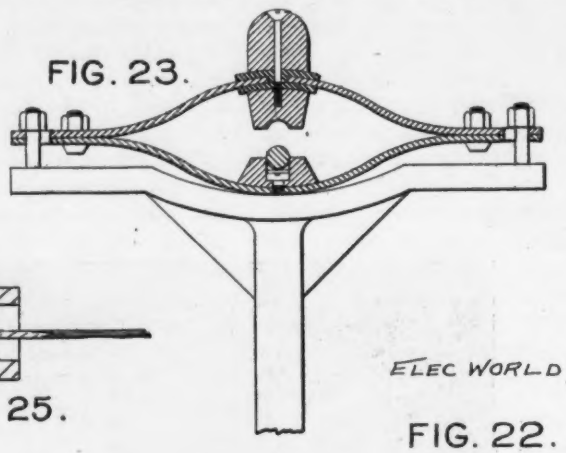


FIG. 23.

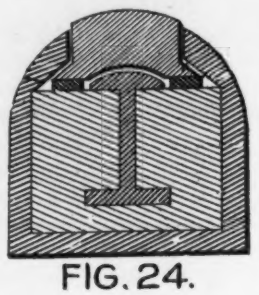


FIG. 24.

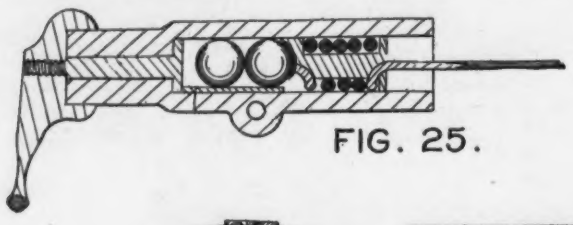


FIG. 25.

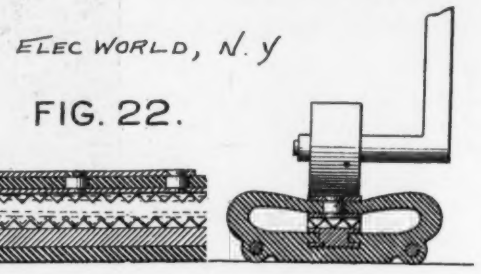


FIG. 22.

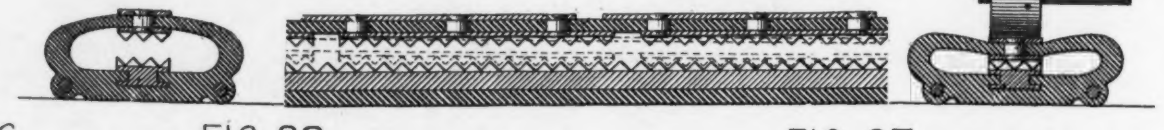
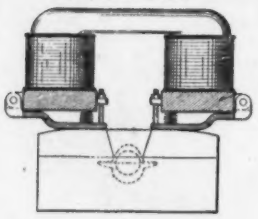


FIG. 26.

FIG. 28.

FIG. 27.



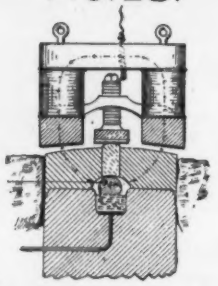


FIG. 29.

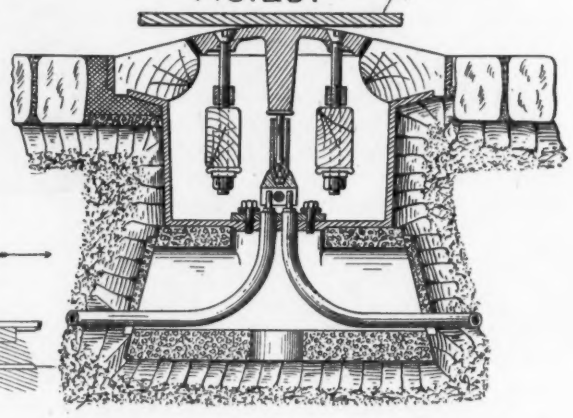


FIG. 30.

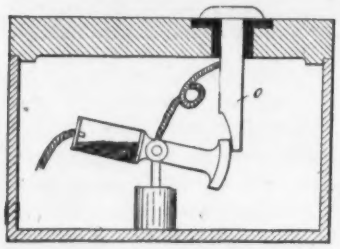
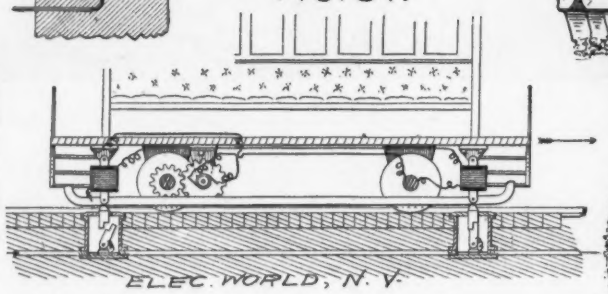


FIG. 31.



a series of electromagnets maintain an elongated field of force, which continuously acts on the circuit closers while the car is over them. In Fig. 28 is shown a very simple circuit closer, designed to operate with such a skate. It consists merely of an iron or steel ball floating in a mercury cup which is connected to the feeder main.

A block of non-magnetic but conducting material is provided just above the ball. The magnetic circuit of the skate is shown by the dotted line in Fig. 28, and its influence lifts the ball partly out of the mercury well into contact with the conducting piece, from the exposed end of which current is taken by means of a contact skate. After the car has passed the magnetic influence is thereby removed, and the ball sinks back into the mercury pool, disconnecting the exposed stud from the live circuit. These automatic devices are cheap and easy to maintain, as is true of almost all of those in which the magnetic skate is employed.

In Fig. 29 is shown another type of contact to be operated by means of a magnetic skate, which differs only in detail from the one just described. An elongated piece *A* is magnetized to a certain polarity by a row of magnets not shown on its upper side. It comes in contact with the curved piece in the roadway, thereby magnetizing it and causing a little plunger in a mercury cup just beneath to rise and make contact. On the removal of the skate the plunger sinks back and breaks circuit. Still another type which requires a skate is shown in Fig. 30. A magnetic stud *O* is placed in contact with a skate, which performs both the office of magnetizing the stud and collecting the current. The action of *O* is to tilt a little casing shown, on its pivot, thereby permitting the mercury which it contains to flow over and connect two contacts. It is essentially necessary thaat the device as depicted be operative in order to avoid the destructive effects of arcing, for if the full arc should occur in the confined space provided, its deflagrating action would be almost explosive.

Another magnetic device is shown in Fig. 31, which differs in principle from those which have been described. The magnetic skate is made north at one end and south at the other. The circuit-closing armatures in the contact boxes are permanently magnetized, so that the operative ends are north poles. The south pole of the skate impinges on and attracts the armature in the contact box. The permanent magnetism of the armature maintains the circuit until the north pole of the skate influences it, when it will be repelled, and gravity assisting, it will break circuit. It is obviously necessary to reverse the polarity of the ends of such a magnetic skate in order to reverse the direction of position of the car.

A second method of retaining magnetic armatures in a position of contact while the car is passing is the use of a magnetic rail. Such a device is shown in Fig. 32. An elongated rail *G* is provided, and a moderately short magnet carried by the car is supposed to influence it so strongly at any point that the plunger *J* floating in the mercury cup beneath will be attracted and held in contact. A brush collects the current from the surface of the rail, and when the magnet is removed therefrom the plunger drops and the rail becomes dead.

Another method in which a short magnet on the car can be used consists of a movable sectional rail, which is placed in a conduit and magnetically influenced and lifted to make contact while the car is passing. Such an arrangement is shown in Fig. 33, which depicts a section of the contact, and to right a perspective of the rail and contact maker. A short magnet carried by the car lifts the rail and connects the feeder to a sectional conductor in the surface of the roadway and maintains the mechanism in that position as long as the magnet is over it. Gravity restores open circuit, but in the meantime the magnet on the car is operating on an adjacent similar device, and thus the supply of current to the motors is uninterrupted.

A unique method which operates isolated magnetic contact studs is shown in Fig. 34. It consists of a chain which passes over two sprocket wheels. This chain carries magnets which are spaced upon it at distances exactly equal to the linear distance between the contact boxes in the roadway. The operation is as follows: A magnet on the chain comes to a lower position and receives current from the motor circuit by means of two contact rails carried on the car. At that instant it is exactly over an automatic contact device which it operates and receives current therefrom. The car proceeds, leaving the magnet in this position and therefore moving the chain on its sprocket wheels and bringing forward the next magnet, which in turn is brought in position over a contact box and energized in the same way as its predecessor. In the meantime the other magnet has passed out of contact with the conductors which supply it with current, and has been lifted from the contact box by the chain and carried forward to repeat the operation. It can be readily seen from Fig. 35, which is a section of the contact box designed to operate with this device, that this method of the chain and magnets is applicable to any case where the magnetic skate is employed. It avoids rubbing friction on both magnetizing and collecting devices, but its complication would probably render the simpler magnetic skate preferable. The magnetic skate is a very undesirable feature. It is long, heavy and cumbersome and liable to give rise to many difficulties, but this or some substitute must be used in order to secure the great financial advantage of a small number of contact boxes. For instance, considering Fig. 36, in which a magnet of short linear extent is shown, the number of contact devices must be much more numerous. There are, however, a considerable number of methods in which the elongated skate is done away with and the contact devices correspondingly increased.

In Fig. 37 there is shown a type which represents a large class of magnetic closers. It might be called a flexible rail method. The flexible rail is in this case a chain, and is fed at proper intervals from the feeder main. It is attracted by a magnet on the car into contact with sectional rails which close the top of the conduit in which it lies, and as the car proceeds the point of contact of the chain shifts, remaining always directly under the magnet. By this means the sections under the car are the only live ones and gravity cuts the others out of circuit.

FIG. 32.

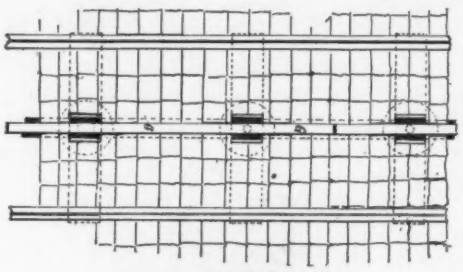


FIG. 33.

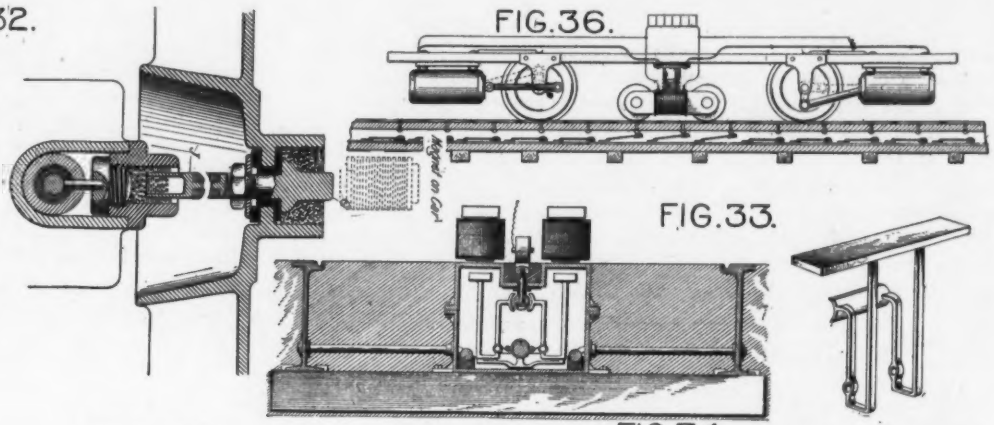


FIG. 34.

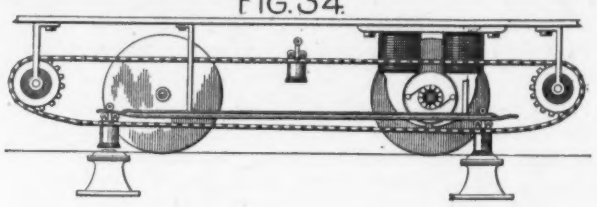


FIG. 35.

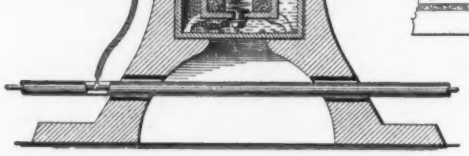


FIG 37.

ELEC. WORLD, N.Y.

FIG. 36.

Central Station Photometry.

BY JOHN W. HOWELL.

It should be the aim of the electrical engineer to simplify and not to complicate the practical problems which he elucidates through the electrical press.

Mr. Buckner Speed's article on station photometry, published in The Electrical World of April 9, would certainly, I believe, prevent the average station electrician from ever putting in a photometer if he considered it necessary to do as Mr. Speed advises.

The accurate rating of secondary standards of light is entirely outside the province of the station electrician—this should be done in a properly equipped laboratory.

The station electrician should buy properly standardized incandescent lamps for his standards of candle power and avoid the trouble and uncertainty of making them.

The construction of a photometer, while a very simple thing to an experienced person, is not a thing I would recommend a station engineer to undertake unless he obtained drawings for it. Such things should be *standardized*. The forms which experience has proved best should be brought into universal use. The American Institute of Electrical Engineers has undertaken this matter and let us hope that final action will soon be taken by it which will enable central station managers to get a photometric equipment which will have the stamp of a competent authority.

A properly designed photometer is quite a simple affair; it overcomes most of the bugbears of photometry and makes practically accurate work possible by central station electricians who have had no training for the work. Standard candles or other primary standards need never be used, neither is a specially prepared room necessary, all that is needed in addition to the outfit is a little "horse sense." Such photometric outfits complete in themselves and quite portable are now used by lamp salesmen employed by the General Electric Company and other lamp companies, and their use has proved conclusively that practically accurate photometry is not a difficult matter with a properly standardized outfit.

A Continuous Integrating Indicator.

To the Editor of The Electrical World:

Sir:—In your issue of April 23, you mention a continuous integrating indicator, described in a recent number of London "Engineering." It may be interesting to your readers to know that an instrument of this kind was devised by two American engineers, Messrs. W. H. MacGregor and R. T. Kingsford, and described by them in "The Electrical Engineer" of July 29, 1896. This indicator was designed to indicate the engine in a test of an electric elevator, and consisted of two ordinary indicators. To the one at the head end was attached a bracket supporting a roll of paper. This paper was unrolled and drawn by the drums of both indicators by rubber rollers fastened to a bracket on the indicator at the crank end. The rubber rollers were driven by belting and countershaft from the shaft of the engine. The indicator pencils, being pressed against the paper, traced continuous wavy curves from which the indicated power of the engine could be calculated. William D. Ennis.

East Pittsburg, Pa.

[The two instruments referred to above, although resembling each other somewhat in their general purpose, differ radically in design. From the American instrument, which might be called a recording indicator in that the pressures during each cycle are successively recorded on a continuous strip of paper, the record may be reduced to hp hours by a proper planimeter, if the distortion due to the diffenence between the motions of the piston and the crank can be properly allowed for. The English instrument, on the other hand, integrates the hp hours and gives the result direct, with no record of the individual strokes and no necessity for the use of a planimeter.—The Editor.]

Large Powers at Low Voltages.

One thousand horse-power is to be supplied at voltages varying from 80 to 200 for the heating of the furnaces in the works of the Carborundum Company at Niagara Falls, N. Y. The power will be taken from the two-phase high-tension circuits, transformed and controlled by apparatus supplied by the Westinghouse Electric & Manufacturing Company.

Is There Any Such Thing as "Cooling Effect"?

To the Editor of The Electrical World:

Sir:—I rather hesitate before disputing so great an authority on arc suppression as Mr. Wurts, but his statements regarding the cooling effect of cylinders of metals are apt to be misleading.

It is certainly true that under many conditions the small electrodes will suppress an arc as well as the larger ones. But if this suppression is to be repeated at frequent intervals, continuing for a long time, it will be found that the larger ones will suppress arcs for some time after the smaller ones have allowed the arcs to form, with current limited only by the resistance in series.

It is not claimed that the few metal cylinders on one of the lightning arresters he mentions will indefinitely prevent an arc from forming when placed across the terminals of a large generator, if sparks are started across the gaps. It is claimed, however, that, if the current is cut down by a comparatively low resistance the large electrodes will act as cooling devices, tending to discourage the arc from holding during the time the E. M. F. wave of the alternating current is at or near its zero value. At the zero point the electrode is out of action, for no current is flowing, and the large mass of metal will certainly prevent the temperature from rising longer than a small mass will. If the current should become permanently established by an arc across the gaps the cooling effect would, of course, amount to nothing, and no one imagines it would be able to reduce the temperature.

In order to make this matter plain, let us take an alternating current arc lamp, reduce the frequency to about thirty cycles per second, and note the time required to start an arc across carbons drawn down to a point one-sixteenth of an inch in diameter. Change these carbons now, and try the same experiment, using carbons three-quarters of an inch in diameter, and flat surfaces for mutual contact. I think the result would prove interesting to Mr. Wurts.

In comparing the effects of the two electrodes of the same composition, when used as arc suppressors, it is not fair to merely note the difference in size. They both are effective as cooling devices to extinguish the arc during the zero period of the E. M. F. wave, but are not such for an infinite period and continuous action. The large spheres are virtually so for practical service, taking into account the number of possible discharges during any storm or similar disturbance, and much smaller electrodes would not prove the same without increase of gap or resistance.

As a matter of fact I have tested, through many storms, a number of electrodes, with tanks of water in series with them, for resistance, and have found an appreciable difference in action and temperature "after the run." The small metal points invariably required a longer gap after acting for some time, showing that there must have been heated vapor present between them, which was absent in the case of the larger ones. H. E. Raymond.

Taftville, Conn.

A Question of Terms.

To the Editor of The Electrical World:

Sir:—Concerning your very appropriate criticism as to the name "underground trolley," under the title of "A Question of Terms," page 518, of The Electrical World, of April 30, I beg to say that I have had occasion to discuss heretofore with clients the proper title for such structures, and agree with you quite fully as to the very inappropriate application of the words referred to.

In a number of patents taken out by me for clients, I have used the term "sub-trolley electric railway"; and in other instances "surface contact electric railway," the latter being undoubtedly proper where the contacts are made by contact buttons extending above the level of the roadbed. It is my opinion that a better descriptive term for the wrongfully named "underground trolley" system would be "sub-surface electric railway."

The "Century Dictionary" defines "sub-surface" as "being or occuring below the surface," so that it appears to me that such a title as indicated would convey fully to all the idea that the electrical features of the entire road were located wholly beneath the surface of the earth.

You are entirely correct in the assertion that the word "trolley" should not, in any sense, enter into the descriptive title of this type of electric railways. Charles J. Kintner.

DIGEST
OF
CURRENT ELECTRICAL LITERATURE
AMERICAN AND FOREIGN
By Carl Hering.

Dynamos, Motors and Transformers.

SPARKLESS REVERSAL IN DYNAMOS. Allen. "Jour. Inst. Elec. Eng., No. 133.—A long, communicated article in which he describes an experimental investigation in which he endeavored to find some of the factors on which the inductance depends, and to see how nearly the results obtained by experiments would agree with the theory. If an armature were surrounded entirely by air or a non-conducting material the energy wasted in each spark would be proportional to the product of the inductance and the square of the change of current taking place during the spark; thus the inductance of the armature becomes of practical importance and as it is small it is not easily determined experimentally; the experiments were made under the guidance and in the laboratory of Professor Ayrton. He describes the measurement of the inductance with alternating currents and the secohmmeter, investigating the effect of various factors, such as the frequency, short circuited field, etc., on the inductance. He also describes the calculation of the inductance in a drum armature; the reversing field which is an important factor in the theory of commutation was also measured. In calculating the loss of energy in a spark he shows that it is equal to half the apparent inductance times the square of the change of current, but this is only true when the resistance of the armature is neglected, for if not the energy lost will be found to be greater. Among his conclusions he states that: (1) The apparent inductance of an armature coil, in the median plane, is nearly the same, whether determined by the secohmmeter or by the alternating current method. (2) Under ordinary working conditions the shunt winding of a dynamo or motor being short-circuited by the armature, acts like the short-circuited secondary of a transformer with considerable magnetic leakage. (3) The result is that the apparent inductance, under these conditions, is about the same as that of the coil on the core when removed from the field, which can be determined approximately by calculation. (4) If the theory is correct, according to which the apparent inductance is represented by certain formula, and if it is possible to reduce the magnetic leakage the apparent inductance can be reduced by this means, thus diminishing the energy lost in sparking when the brushes are not exactly adjusted. (5) The apparent inductance when the coil is at right angles to the median plane does not differ very much from the true inductance, as determined by measuring the flux with a continuous current. (6) In finding the apparent inductance of a ring armature, the external field is regarded as being the same as in the case of a drum. The field in the interior of the core has also to be taken into account. (7) The magnitude of the reversing field is shown by experiment and by theory to be very small. (8) The variation in flux through the armature when sparking occurs can be observed by means of a fixed coil, wound outside the armature, or upon the pole piece, and connected to an alternating-current voltmeter. It is shown that this variation is small in a machine which is running with little sparking.

PREDETERMINATION OF THE MAGNETIC LEAKAGE OF TRANSFORMERS. Kapp. "Elek. Zeit." April 14.—A reprint of a recent paper read before the Electrical Society. In a previous paper (see that journal No. 17, 1895), he described a graphical method for determining the fall of voltage in transformers, but in this it was necessary to make a test of the completed transformer; if it were possible to determine certain relations from the drawing and winding data of a transformer this test would become unnecessary; in the present article he shows how this can be done; it is based on the determination of the E. M. F. which will be induced in both the windings by the leakage field; it appears to be ingenious, but does not admit of being abstracted briefly. In the discussion Goerges stated that the leakage is inversely proportional to the square of the magnetism, from which it follows that in transformers for a small drop in voltage the magnetism should be as high as possible; but the reversal of the magnetism would then require more energy, and therefore the loss at no load would be greater: in the latter case the magnetism should for this reason be kept low; the constructor must, therefore, choose beween these two, the choice depending on the objects of the transformer. Roessler suggested that when the coils are subjected to only a small voltage, as seems to be necessary in the above method, the magnetic conditions might be quite different, and therefore the leakage ratios would differ also. Both Goerges and Kapp showed that this error would be very slight.

NOTES ON SINGLE PHASE MOTORS. Eborall. Lond. "Elec Rev.".—The concluding installment of his serial (see "Digest" March 5.). In the issue of February 25 he discusses the advantages of the simple squirrel cage motor; April 18, the Brown and Boveri induction motor and starting devices; April 1 and 15 single phasers made by different companies. In conclusion he considers the excellent performance of some of the motors made is such that it is difficult to understand why complaint is made that such motors cannot be run for lighting circuits.

OPERATION OF MULTIPHASE CURRENTS. Hawkins. Lond. "Elec.," April 15.—An illustrated abstract of the paper noticed in the "Digest," April 23.

MARINE LIGHTING PLANT.—Lond. "Elec. Rev.," April 15.—An illustrated description of a direct-coupled unit for a British ship. The Admiralty found the two-pole iron-clad type too heavy, and has now adopted a multipolar machine in which the leakage is kept to a minimum; the machine illustrated has four poles.

EXPLOSION OF A TRANSFORMER.—"Eng. News.," April 28.—A note stating that a high tension transformer with oil insulation recently exploded in St. Louis; it is said that one of the inner connections gave out, causing arcing, which ignited the oil.

Lights and Lighting.

THE NEW AUER (OR WELSBACH) INCANDESCENT ELECTRIC LIGHT.—"Zeit. f. Beleucht.," April 10.—A long abstract of the recent Austrian paper of Auer von Welsbach. Osmium cannot be vaporized even at the temperature of vaporization of platinum or iridium, whether in vacuum or in certain reducing gases. If an osmium wire is heated in a Bunsen flame or in vacuum, and a current passed through it raising it to the temperature of vaporization of platinum, a brilliant white light of great intensity is produced; in vacuum it can be heated much above this temperature without melting, but with a relatively very great current it will melt through at one place; it seems to be the most infusible body known, and at the same time the one which gives out most light at high temperatures; with the increase of light emission the heat emission is decreased. The osmium preparations in commerce are not sufficiently pure for this purpose; the properties are not changed very much by the presence of a small amount of platinum. Next to osmium comes ruthenium; pure osmium is quite elastic, and is suitable for filaments; to make these filaments he describes several processes. The osmium is deposited in a metallic state on a fine wire which is then vaporized by means of a current. A very fine platinum wire in a reducing atmosphere has a current passed through it; in the presence of hydro-carbons there should be considerable water vapor to prevent the formation of osmium carbide which is easily fusible; from time to time small quantities of volatile osmium combinations, such as the tetroxide, are introduced into the surrounding atmosphere; the layer should be formed slowly and evenly and the deposit should be a brilliant bluish white, without blow holes; the layer is very brittle. The wire is then placed in a reducing atmosphere, and brought gradually to the vaporizing temperature of platinum and then above, when all but a little of the platinum will pass off, after which the wire is somewhat elastic. The process may be modified by painting the platinum wire with a dilute solution of some osmium compound, or by dipping and then heating it; this must be repeated about 100 times. It may also be done electrolytically from a solution. When the method of painting the filament is used the filament may also be of vegetable or animal fibres. It should be drawn through a die to make the deposit uniform; after this, two or three filaments may be twisted together. After drying, the filament is brought to its proper form and heated in a reducing atmosphere; it is mounted and heated, and if not uniform is made so by one of the above processes. Threads, discs or other forms may also be made by a process resembling that of the manufacture of artificial silk, with the use of collodium. Threads like those of wool may be obtained by using fine vegetable threads not twisted too tightly and impregnating them with a thin paste of an osmium compound in water, such as the sulphide, adding a binding material, such as sugar, and after drying it is heated in a reducing gas. He describes a peculiar phenomenon; if a platinum wire is covered with thoria a current may be passed through it much higher than that which would melt the platinum, as the energy, which would otherwise be transformed into heat is largely transformed into light; by increasing the current a brilliant light will be produced at one place which will gradually extend over the whole thread, and a small globule will pass out, it being the melted platinum, after which the current can be still more increased, and less heat, but more light, will be generated, until finally the thread is destroyed. Any thorium compound can be used, which, on being heated to incandescence, leaves the oxide; if the coating process is continued fifty times the layer will be sufficiently thick: he obtains bright, glassy and very adhesive coatings of this oxide on platinum with very dilute solutions, for instance, of the nitrate, repeating the process several hundred times, the manipulations being carried out by machinery. Zirkon can also

be used, but the rare earths and magnesia, calcium and clays melt at too low a temperature; instead of platinum an alloy of platinum with osmium, ruthenium, rhodium or iridium may be used for commercial filaments for lighting. In conclusion the claims of the patent are given.

The Lond. "Elec. Rev.," April 15 contains an article by Gibson, also giving a summary of the patent with some opinions. It is remarked that although not stated in the specifications it is evident that the best results with these filaments can only be obtained with the use of alternating currents; it is thought that the cost of producing these filaments must be considerable; attention is called to the omission of a description of the electrolytic method, although such a method is known; it is intimated that there seems to be little that is new and patentable in this method.

MANUFACTURE OF LAMPS AND OTHER APPARATUS FOR 200-VOLT CIRCUITS. Byng. "Jour. Inst. Elec. Eng.," No. 133. The complete paper, with the discussion noticed in the "Digest," April 9, and The Electrical World," March 9.

INCANDESCENT LAMP SOCKETS.—"Zeit. f. Beleucht.," April 10.—Illustrated descriptions of a number of recent improvements in electrical lamp bases and sockets.

JANDUS LAMP. Barton. "Zeit fuer Elek.," April 10.—A reprint of a recent lecture in Vienna.

Power.

ELECTRICITY ON BOARD SHIP. Tidd. The continuation (apparently the conclusion) of the reprint of his long paper (see "Digest" last week. The electric light machinery should be capable of being worked from a donkey boiler, and connected to the main boilers with the aid of a reducing valve. Alternators were tried, but now, without exception, direct connected continuous current machines are used, and are almost universally made of the inverted vertical type, with the armature at the bottom; the drum and bar windings have advantages over the Gramme ring; mica should be insisted upon for the commutators; he prefers copper gauze cut crosswise for the brushes, carbon brushes being used for motors. He then discusses the question of the switchboard, which should be placed as near as possible to the dynamos; an illustration is given. The three methods of wiring are discussed separately, the one most generally used being the double wire, with insulated return and which he considers the best; the best example of the earth return system is the concentric system; the distribution system has now replaced the "tree" system, the mains passing without branches to distributing boards, from which wires are run without joints to fuse boards and from there to the lamps without a joint. Masthead, side and cargo lights are discussed. The Suez Canal plant, with the aid of which vessels are allowed to pass at night through the canal, is described. In conclusion he mentions other possible uses of electricity on board ship, chiefly for power purposes.

LARGE POWER DISTRIBUTION PLANT.—Lond. "Elec.," April 15.—A note stating that there is a project under consideration for a large power station at the Haenichen coal fields, near Dresden, Germany, from which it is proposed to supply the entire kingdom of Saxony with current for factory, tramway and lighting purposes, including not less than 168 towns; no further information is given.

STEAM TURBINES IN SUPPLY STATIONS.—Lond. "Elec. Eng.," April 15.—Several discussions of the advantages and disadvantages.

1000-HP HIGH VOLTAGE TRANSMISSION.—"Elec. Eng.," April 28.—A brief account of an experiment at Ogden, Utah, made to find the limits to which the high voltage circuits might be used commercially. An existing installation was used in which 1000 horse-power was sent over 36.5 miles at 30,000 volts over three No. 1 wires, the power being sent over a loop and received at the original station (from which it would appear that the difference of potential between the line wires was not 30,000 volts). The loss was claimed to be 9 per cent., including 4 per cent in the two sets of transformers. In another experiment the load was at the distant station, and the voltage then was 24,000, the power delivered being about 500. The conditions were very severe, as the lightning arresters were discharged repeatedly, although without interrupting the transmission.

COST OF NIAGARA POWER IN BUFFALO. Emery. "Elec. Eng.," April 28.—An article on the recent reduction in price to what he considers a rational basis. He suggests that the company should deliver power as distinguished from current, that is they should install the motors themselves. With this change and a proper scale of discounts, considerable power should be sold in Buffalo.

ELECTRICALLY PROPELLED CRUISERS.—"El'ty," April 27.—An editorial stating that the Navy Department is considering the invention of Painton, who claims to be able to propel a cruiser at 40 knots an hour with electricity as power; he proposes to use from ten to sixteen independent propellers; the vessel is to be about 600 feet long; an exceedingly short length of shafting operated independently will be used; no further description is given.

Traction.

ELECTRIC TRACTION ON STEAM RAILROADS.—"Elettricita," 2, p. 17, a German translation of which is begun in the "Elek. Anz.," April 10.—The first portion is introductory in character. The present steam locomotives will develop 1800 horse-power at a weight of 70 kg per horse-power, figures which will not be greatly improved; a train weighing 100 tons can be drawn at a speed hardly exceeding 125-km per hour.

UNDERGROUND ELECTRIC RAILWAY IN PARIS.—"L'Ind. Elec.," April 10.—A reprint of the bill passed by the Senate and Chamber of France concerning the underground electric railway which is to be constructed in that city. Some of the data concerning this line, which is to be commenced at once, is also given in "Eng. News." (N. Y.), April 28.

LONDON CENTRAL UNDERGROUND RAILWAY.—Lond. "Elec. Eng.," March 11.—The continuation of the illustrated description.

NARROW GAUGE LINE. Werther. "Elek. Zeit.," April 14.—An illustrated description of a short private line in Holland for connecting a beet sugar factory with a railroad. It concludes with some tests of the efficiency of the locomotive and its traction resistance. The measurements were made with a volt and ammeter and a dynamometer; a formula gives the relation between the quantities involved, and with the aid of two experiments, the two desired unknown quantities are calculated.

MIXED TROLLEY AND ACCUMULATOR CAR.—"L'Elec.," April 9.—A brief illustrated description of the one which is being run experimentally in Paris; it is a double deck car, contains 230 cells and has two General Electric 800 motors.

CONDUIT SYSTEMS. Pellissier. "L'Eclairage Elec.," April 9.—A continuation of his serial giving illustrated descriptions of various systems.

AUTO-CARS. Simon. "L'Elec.," March 19 and 26, April 26.—The first part of an article on the study of the motors of such vehicles, on the determination of their power and their relative qualities in the various systems in use. The present portion seems elementary in character. In the third installment he discusses the steam, petroleum and electric motor, but appears to give nothing new.

ELECTROMAGNETIC BRAKE.—"Elek. Anz.," April 10.—An illustrated description of the Siemens & Halske form of brake, which is in principle the same as the one described in the "Digest" last week, differing from it merely in mechanical details.

CHICAGO ELEVATED.—"Eng. News.," April 28.—A note stating that electric cars are being gradually introduced on the old Alley line to replace the steam locomotives; the Sprague multiple unit system is used; when this is completed there will be no more steam locomotives on any of the elevated lines in Chicago; the speed on the other lines is by no means equal to that of the steam trains on this one.

SURFACE CONTACT SYSTEM.—"El'ty," April 27.—A reprint, without the illustrations, of the description of the Kingsland system noticed in the "Digest," April 9.

Installations, Systems and Appliances.

COST OF GENERATING AND DISTRIBUTING ELECTRICAL ENERGY. Hammond. Lond. "Elec., April 15.—The conclusion of the long abstract of his paper (see "Digest," last week). In this he considers the probable influence of the most important of the factors on the further reduction of the cost of production and distribution. Quite a number of diagrams are reproduced, showing the relations between various factors and the units sold, for each of a number of different stations; a table also shows the fall in cost accompanying an increase of output. Under the heading of "Depreciation" he states that most local companies allow 3 per cent. of the capital expenditure for depreciation and antiquation, and find it to be sufficient, with which he concurs; Glasgow allows 6.36 per cent., while in Aberdeen it is 2.6. In conclusion he makes a prophecy concerning the reduction in cost in an industrial centre, which he thinks will be at Leeds; he believes that when the output there will reach 5,000,000 units the cost of production and distribution (which he itemizes) will be, works costs, 1 cent per unit sold, and the total, including rates, taxes, management, 1.5 cents. The Lond. "Elec. Rev.," April 15, concludes its brief abstract. The whole paper, which is very long, with the numerous tables and diagrams and the discussion, is published in No. 134 of the "Jour. of the Inst. Elec. Eng."

GENERAL STATION ACCOUNTS.—Lond. "Elec.," April 15.—An analysis of the accounts of the Burton-upon-Trent and the Northampton stations, which are small but are said to be instructive.

COLOGNE.—"Elek. Zeit.," April 14.—Long tabular extracts from the report of operation for the year 1896.

LONDON. A. H. Preece. Lond. "Elec.," "Elec. Rev." and "Elec. Eng.," April 15.—An abstract of a recent paper on the central stations in London, read before the Institution of Civil Engineers. There are now in London eleven important companies and five vestries, while six others are in progress; the capital invested is $30,000,000; the power installed is 80,000 horse-power, the equivalent of 2,000,000 lamps of 8-cp being connected to the mains; the total annual revenue is $4,000,000, and the expenditures $2,250,000. A list is given of those using alternating and of those using direct current. The preference for the water tube boiler is marked, as there are

sudden demands caused by fogs, for which the quick steaming properties of this boiler are a great advantage; the tendency is toward marine type engines of large output; the high speed engine is not used for larger powers than 750-hp, some engineers finding 350 sufficiently large; the dynamos are always directly connected; storage batteries are not extensively used, although some stations use them entirely after midnight; high-speed engines must have three cranks. The favorite methods of distribution are heavily insulated cables in iron pipes for high pressure transmission and insulated cables in stoneware conduits, or heavily armored cables laid directly in the ground, for low pressure distribution; rubber is little used, paper and jute being preferred. The usual measurement of supply is by meter, for which the average charge is 11 cents per unit; the average charge for current was 15 cents in 1890, but is now reduced 25 per cent.; a few lines below he states that the usual cost now is from 5 to 6 cents; the actual cost of generating is 3 cents, and the cost of management, etc., 2 cents; the direct current is everywhere produced at a cheaper rate than the alternating, about 20 per cent. cheaper. A comparison is made between the two largest companies in London, one using the alternating and the other the direct current, both having about the same number of lamps connected, which is a little over a quarter of a million; the capital expended was little less than $5,000,000 in the one and a little more than half this in the other; the annual income per 8-cp lamp is 29.3 cents and 19.3, respectively; the annual expenditure $1.00 and $0.75, and the cost per unit 15.2 and 11.9 cents. The industry is growing rapidly, and not less than 40,000 horse-power is now being installed in order to meet the demand. A briefer abstract of the paper is reprinted in "El'ty" (N. Y.), April 27.

CONNECTING ALTERNATORS IN PARALLEL. Schueler. "Elek. Zeit.," April 14.—A long abstract of a recent paper describing a method for automatically connecting alternators in parallel. The engine of the one to be connected is brought to nearly the proper speed, and if a current is then sent into it from the other machine or bus bars, it will be brought to synchronism, provided the current is strong enough; a variable resistance may be put into the circuit, it being short-circuited after they are in phase. In place of this resistance a sort of transformer may be used, consisting of two like coils on two opposite sides of a square frame of iron, and an adjustable iron core, which may be inserted between the two coils and joining the two yoke pieces; the transformer ratio is one to one; one coil is connected to one alternator and the other to the bus bars; when the movable core is between the coils they will be independent, but as it is gradually withdrawn the coils will affect each other more and more, bringing the two machines into synchronism. Instead of this movable core a fixed core with a separate coil may be used, this coil being gradually short-circuited through a resistance. Another device to replace the phasing lamps consists of an ordinary three-phase motor with sliding contact rings in which the number of windings in the short-circuited armature is equal to that on the exciter; these two circuits are connected respectively to the two alternators; the action of the two circuits will bring the two machines into synchronism and the speed of the motor will diminish until finally it has come to rest, which indicates the state of synchronism; to show, furthermore, whether the currents are then in phase or not, a pointer is secured to the shaft which shows the angle between the two phases; the machines should be electrically connected when this pointer points to zero. A modification of this consists in applying a brake to this motor; when the shaft is brought to rest they are in synchronism, after which the shaft is turned by means of the brake until the currents are also in phase. The tests he made were with a 10-hp motor for a 100-hp machine; the size of the motor depends on the engine, but can generally be taken at about 5 per cent. of the output. Still another device is shown in which an automatic interlocking is brought about by regulating the steam supply; a motor is connected to one alternator and a certain pulley traveling on a screw thread on the motor shaft is revolved from the other by means of a belt; when the speeds are not alike this pulley will travel on its threads, and by means of a lever will regulate a valve in the steam supply, but when the speeds are equal the pulley will not travel axially. In the discussion the devices were thought to be too complicated.

PARALLELING ALTERNATORS. Matulka. "Zeit. fuer Elek.," April 3.—A communication describing his experience in the plant at Marienbad, which he thinks is the first installation where alternators driven by separate engines were run in parallel, which was done there by him as early as 1889. He describes a case in which three alternators, after a stoppage, had to be started with a large load connected to the circuits. The first machine was connected with the circuits and regulated so as to give its maximum current, at which it developed about 60 volts in the secondary, the normal for which was 110; the second machine was then loaded with an artificial load to the proper voltage (110 in the secondary), and after synchronizing was connected in parallel, both of the machines being then regulated for their normal current; the third machine was then similarly connected; the whole operation required but five minutes. In connection with the arrangements suggested by Sahulka (see "Digest," April 2 and 16,) he recommends putting a switch in both circuits in order to disconnect the machine entirely when not in use.

PARIS. Soulier. "L'Ind. Elec.," April 10.—The conclusion of the long illustrated description of the station at the Quai de Jemmapes (see "Digest," April 23,).

220-VOLT SUPPLY. Lond. "Elec. Eng.," April 15.—Arguments for and against such a supply from the consumer's standpoint.

Wires, Wiring and Conduits.

TELEGRAPH AND TELEPHONE WIRES. Dubreuil. "L'Elec.," April 16.—A discussion of the relative advantages of wires of different metals, with regard to their conductivity, strength and price. The chief results have been combined in the accompanying table. By the electric equivalent he means the weight of wire

	Resistance.	Electric Equivalent.	Price.	Economical Equivalent.	Tensile Strength.	Mechanical Value.
Iron	8	64	0.26	16.64	40	5
Copper	1	9	1.75	15.75	45	5
Steel	12	96	0.40	38.40	100	12.5
Bronze	2.5	22.5	2	45	75	8.3
Bi-metallic	1.66	15	1.50	22.50	75	8.3
Aluminum	2	6	5	30	30	10

which will have the same conductivity for the same length; by the economical equivalent he means the product of the electric equivalent by the price per unit, and this gives the cost for lines equivalent electrically; the "mechanical value" is determined by dividing the tensile strength per sq. mm., by the density, and the result, therefore, is independent of the diameter of the wire; this column also represents the coefficients of security when these wires are strung parallel between the same poles; all these coefficients of security may be made the same by stretching each wire with a tension proportional to the numbers in that column; a greater tension then corresponds to a greater span. Each kind of wire is then briefly discussed; steel is no longer used except in rare cases; wires of alloys have given good satisfaction; the objections to bi-metallic wire (steel inside and copper outside) are that its properties are not constant, differing in different lots, but they can evidently be improved; the advantages of aluminum will improve with a reduction in the price, but it is now inferior to bronze wire, owing to its lack of strength and to the fact that it cannot be soldered; alloys of aluminum may be found to overcome these objections. He concludes that copper is the only metal to be used for interurban lines; iron is used only for unimportant ones or where the copper wire would be too small; bronze wire is at present the best for urban lines, which bi-metallic and aluminum wires have a chance of replacing these at some future time.

WEATHERPROOF WIRE. Dow. Lond. "Elec. Rev.," April 15.—A reply to the recent criticisms of his former article, defending weatherproof wire as used in America.

ALUMINUM AND COPPER FOR CONDUCTORS. Hunt. "Elec. Eng.," April 28.—A short reply to the recent criticisms of Dow (see "Digest," April 9,). The claim that a greater transverse strength of poles will be required, does not take into consideration the fact that the dead load of aluminum is much less than that of the copper for an equal conductivity; 48 per cent. of the weight of the copper will give a section of the aluminum wire of equal conductivity; that is, the section will be 100 for copper and 160 for aluminum, while the weight will be of 100 for copper and 48 for aluminum; when this is taken into consideration the strains on the poles will be found to be much less, even with a greater wind pressure. Regarding the increased snow-load, he has been told by those who have had large experience that this load will not be increased, as it seems to be almost independent of the size of the wire (but he mentions no authority for this). Aluminum can be furnished with a tensile strength of 40,000 pounds per sq. in., while hard-drawn copper wire has 65,000; a section of 160 for aluminum as compared with 100 for copper will have an equal if not slightly greater tensile strength. He quotes from a letter from Fitch, of a telephone exchange, in which he states that the aluminum wire which he has used has been very satisfactory, and has stood the storms without the least impairment; the last spans were 450 feet, and a span of 600 feet has now stood through two winters, and is in perfect condition.

Electro-Physics and Magnetism.

CURRENTS PRODUCED BY COLD. Bakhmetieff, Christodulos and Georgieff. "L'Eclairage Elec.," April 9; abstracted from the Russian journal of the Physical-Chemical Society, 29, page 14.—It is generally known that when a metal is heated or cooled electric currents are produced; the present authors have been studying this phenomenon for the past year, and have shown that the cooling of metallic magnetic wires, which have been heated by an electric current, produce refrigerating currents; also that they have obtained the currents by cooling fused diamagnetic metals. The currents may be explained by the aid of thermo-electricity; those metals which, by solidification, change in volume most are those which develop the strongest currents; they therefore suggest the hypothesis that these cooling currents are due to a variation of the volume, in the mass of which the ether enters or passes out, producing an electrical current. The direction of the current is the same as that of the terrestrial current at the locality; the currents also depend on the rapidity of the cooling. Their experiments, to verify their hypothesis, are then described. From these they conclude that the cooling currents depend on the temperature of the surrounding medium and they are greatest when this temperament is lowest.

CONDUCTIVITY.—Lond. "Elec. Rev.," April 15.—A brief abstract of an article by Fritsch from the "Ann. de Physique et Chemie," 2. No. 60, in which he determined the conductivity of a number of solid substances such as precipitates or compressed plates, and examined the effect of small quantities of foreign matter. The effect of a small quantity of a second salt is in nearly all cases to largely increase the electrical conductivity. A table from an article by Loomis in the same journal is also reproduced, giving the conductivity, in mercury units, of solutions of various chemicals at certain specific gravities.

PERIODIC CURRENTS. Rhodes. Lond. "Elec. Rev.,"April 15.—A short article calling attention to the exorbitant amount of mental effort required in the graphical representations used in the writings of some authors, and giving the conclusions in the recent articles of Vaschy and Pomey, who suggested modifications in the methods. He claims that by the combined aid of analysis and graphics, problems which are otherwise formidable are solved with ease and require only an elementary mathematical knowledge. He believes that vector algebra will before long form the base of the calculations of all "useful" text books on alternating current phenomena.

CHEMICAL ACTION OF ELECTRICAL OSCILLATIONS. Hemptinne. "Zeit. fuer Phys. Chem.," No. 22, 1897; abstracted briefly in the Lond. "Elec. Rev.," April 15.—The article has already been noticed.

CATHODE RAYS. Villard. "L'Elec.," April 9.—An abstract of a French Physical Society paper in which he gives the results of researches with Crookes tubes. He found that the resistance measured by the equivalent spark depends solely on the cross-section of the origin of the cathode beam, the section being smaller the higher the degree of vacuum; this decrease of the diameter of the beam is due to the action of the walls of the tube. He explains all the phenomena noticed by assuming that a gas charged positively leaves the different parts of the tube and arrives at the cathode. He also examined the nature of the cathode material, and concludes that the cathode rays are slowly formed by the hydrogen, generally from the water vapor which remains in the tube; he showed samples of crystals or glass covered with a compound of copper and reduced by the cathode rays.

LOCATING OBJECTS BY ROENTGEN RAYS. Niewenglowski. "Cosmos," April 16.—An illustrated description of the Mergier method and apparatus which was recently shown before the French Academy of Medicine, and with which bodies are said to be easily located without any calculation, and with a precision greater than that necessary in practice; the apparatus appears to be quite simple.

RADIATION IN A MAGNETIC FIELD. Michelson. "Phil. Mag.," April.—A short, illustrated article. An analysis of these radiations shows that the phenomenon is much more complex than was supposed, and an examination of the separate components of the "triplet" shows that in general these are multiple lines. The general laws are summarized and his investigations are described.

PROPERTIES OF ELECTRIC DISCHARGES IN MAGNETIC FIELDS. Broca. "L'Elec.," April 16.—A reprint of a short French Physical Society paper.

MAGNETIC SHIELDING. Du Bois. Lond. "Elec.," April 15.—In this continuation of his long series he discusses permeability and describes a "shield permeater," which, he says, is convenient for rapid everyday work; he discusses the applications of shielding with alternate layers of very high and very low relative permeability.

PORTABLE X-RAY APPARATUS.—"Eng. News.," April 28.—A note stating that Fessenden has constructed a portable apparatus for use in war, which weighs only 25 pounds and is no larger than a Webster dictionary; it is operated by a gasoline motor or turbine, which does not weigh more than 25 pounds; the electric generator is said to be the smallest ever made for practical purposes; the apparatus is powerful enough to see through the body.

GASEOUS MATTER IN CROOKES TUBES. Swinton. "El'ty," April 27.—A reprint of the abstract noticed in the "Digest," April 23.

Electro-Chemistry and Batteries.

PREPARATION OF GLUCINIUM BY ELECTROLYSIS. Lebeau. "L'Ind. Elec.," April 10.—A short Academy note, in which, after mentioning the other methods, he describes the one which he used. He obtained the metal in its pure state from the fluoride; as this compound when fused does not conduct, some fluoride of sodium or potassium is added. The Marignac method of preparing the salt is briefly described. The electrolysis is carried on in a nickel crucible which is the negative pole, the positive electrode being graphitic carbon. The salt is first fused over a burner, and after the current is started it will remain fused; too high a temperature should be avoided, and it should not exceed a dull red; in his test the current was 6 to 7 amperes at 35 to 40 volts; in forty-five minutes a coating was formed over the nickel, which was readily separated from the crucible by means of boiling water.

ELECTROLYTIC OXYGEN AND HYDROGEN. Hammerschmidt and Hess. "Elek. Anz.," April 10.—A reprint of the article, an abstract of which was noticed in the "Digest" last week. An abstract is also given in the "Elek. Zeit.," April 14.

COLORING BRONZES.—"Elektrochem. Zeit.," April 1.—An abstract of a description by Lissmann of his process of coloring or aging bronze castings. For an electrolyte he uses the natural mineral waters impregnated with carbonic acid gas; the current is 1 ampere per square m., and the voltage about 3; the carbonic acid gas developed at the anode will carbonize the metal, forming an adherent green coating; by suitable regulation the color may be made light or dark.

COATING ALUMINUM.—"Elektrochem. Zeit.," April.—Some notes showing how to pickle, polish and galvanize aluminum. Another short abstract in the same number describes how to plate with an alloy of gold and aluminum.

ORGANIC ELECTRO-CHEMISTRY. Krueger. "Elektrochem. Zeit.," April 1.—The first part of what promises to be a long article, in which he will discuss the effect of the current on organic compounds, the effect of the action of the induction spark, the arc and the dark discharge, after which he will consider the electrolysis of organic conductors, and the effect of electrolytically generated elements on organic compounds.

DIAPHRAGM. Ochs. "Chemiker Centralblatt," 1, p, 289; noticed briefly in the Lond. "Elec. Rev.," April 15.—He discusses the question of whether a diaphragm exists which will prevent diffusion but not the passage of the electrical current (meaning apparently the passage of the ions). He concludes that diaphragms of the kind for practical purposes are at present unknown.

MOUTERED ACCUMULATOR.—"Electrochem. Zeit.," April 1.—An illustrated description. The circular leaden retaining cell has horizontal grooves on the inside surface, which are filled with the active material, and is the positive plate; the grooves are filled with the active material; the idea is that as these rings of active material expand, as they will do in a discharge, they will force themselves against the metal, and will therefore adhere all the more tightly; this material will therefore not drop out. The negative plate is made of a cylinder covered with spongy lead, and then with a perforated lead plate. The capacity is 35 watts per kg, including the liquid (and the cell itself, which is one of the plates); it is therefore said to be especially adapted to carriage work. Results of tests are given in tables, and a curve, which latter shows the variation of the capacity with the discharge currents.

THEORY OF REVERSIBLE CELLS. Darrieus. "Elek. Anz.," April 14.—A German translation of that portion of his serial on the action of the electrolyte on the negative electrodes. (See "Digest," April 23.)

ELECTRO-CHEMICAL AND METALLURGICAL INDUSTRIES. Kershaw. "El'ty," April 9.—In this continuation of his long serial he describes the Hermite bleaching and disinfecting processes. In the continuation in the issue of April 27 he gives an account of the processes which have been or are being used for producing antimony, chromium, magnesium and nickel on an industrial scale.

Units, Measurements and Instruments.

ACCUMULATOR TESTS. Hospitalier. "L'Ind. Elec.," April 10.—A short article in which he discusses the various ways in which accumulators are tested, namely, with a constant resistance, with a constant discharging current or with a constant discharge in watts. The first is the easiest and gives the most favorable results, while the last gives the most useful results; it is therefore a question which should be adopted; the third is the most complicated, as it requires continual calculations and adjustments; the second is the most rational, but also requires continual adjustments, and for this reason preference is given to the first, which is the most simple and the one most used in practice. The question then arises, what should be taken for the discharging current, whnch is then a variable quantity; this, he states, should be calculated from the total discharge in ampere hours divided by the time of the discharge, thus giving the mean circuit. Stopping the discharge at 1.8 volts on closed circuit does not give correct comparisons, as this voltage will depend on the current; he therefore recommends stopping when the voltage is 1.8 immediately after interrupting the current, as this gives results independent of the external resistance. In accumulators for moving vehicles the weight given should always be the total and not that of the plates alone. He agrees that a uniform system should be adopted for making accumulator tests.

MEASURING THE POWER OF THREE-PHASE CIRCUITS. Aliamet. "L'Elec.," April 16.—A description of the method recently described by Fry (see "Digest," January 1), and used in the Institute in Hanover. He admits that the method is simple and ingenious, but it contains nothing new except the convenient arrangement of the apparatus; it has its advantages; the results are correct only when the phase shifting in the several circuits is exactly the same, but this perfect symmetry is difficult to obtain with motors and transformers. He greatly prefers the method of measuring the watts successively in each circuit, which is more exact, as the circuits can then be unequally loaded, and the phase shifting can be different. He believes that it is decidedly better to go to the expense of obtaining a wattmeter for each circuit instead of using only one.

MEASURING LOW TEMPERATURES. Meyer. "Elektrochem. Zeit.," April 1.—He describes some experiments made with the resistance of platinum from 0° C. to the boiling temperature of liquid air, giving a curve and a formula from which it would fol-

low that the resistance would be zero at —258.3° C.; the lower the temperature the more incorrect would be the results. He then describes magnetic methods; one of these consists in making a sort of transformer with an iron core, the permeability of which will vary with the temperature. It appears that the methods can be used only with certain restrictions; he does not seem to have tried it, but simply offers the suggestion.

RECORDING VOLTMETER.—Lond. "Elec." and "Elec. Rev.," April 15.—A very brief illustrated description of a drum registering device, in which, by means of cams, seven different daily records, thus corresponding to a week, may be taken on the same drum; the arrangement is said to be an equivalent to moving the drum along its spindle a short distance each day. The arrangement of the cams is not described, and the illustration is too poor to show this.

REGISTERING INSTRUMENTS. Marxen. "Elek. Zeit.," April 14.—A long abstract of a recent paper on recording instruments in general, with special reference to those made by Hartmann and Braun.

MEASURING THE INTENSITY OF MAGNETIC FIELDS. Bouty. Lond. "Elec. Rev.," April 15.—A translation of the article noticed in the "Digest.," March 5. It is reprinted in "El'ty" (N. Y.), April 27.

CONDENSER SHUNTS. Raymond-Barker. Lond. "Elec. Rev.," April 15.—A short article on capacity tests of long cables, giving a rule which was suggested some years ago to the effect that either or both the cable and the condenser must be so shunted that the dielectric resistance per microfarad will be the same in both the inductive systems. He shows the correctness of this rule and gives some examples.

THERMOPILE PYROMETERS. Stanfield. "El'ty," April 27.—A reprint of the note noticed in the "Digest," April 23.

Telegraphy, Telephony and Signals.

TELEGRAPHY ACROSS SPACE. S. P. Thompson. Lond. "Elec. Eng.," April 15.—The beginning of a reprint of a Society of Arts paper in which he describes and shows what has been done by the three methods, the conduction, the induction and the wave method. The longest distance yet reached with electric waves is thirteen miles over open country, in which the length of the wires at the base lines at each end were nearly 1000 feet. The paper is interesting reading, and appears to be a very good summary.

The Lond. "Elec." contains a communication by Wilkens claiming that Thompson has jumped at conclusions in claiming that it would be possible to establish electrical communications from England to America, and he believes that Thompson is not taking into consideration that the earth is a globe and not flat. In another communication by Grove, also criticising the claims with reference to the use of syntony, he thinks that limits will be found for signalling in this way, as the range within which instruments can be tuned is supposed to lie within an octave, owing to the existence of overtones or harmonics.

RECEIVER FOR WAVE TELEGRAPHY. Rupp. "Elek. Zeit.," April 14.—A brief illustrated description of what appears to be an exceedingly ingenious and simple device. In using the Branly coherer the dots and dashes are not sharply defined, and with the present system this is overcome, while the receiver is greatly simplified, as the mechanical jarring or tapping device is entirely done away with. It consists simply in mounting the coherer, which is in the form of a tube, so that it may be continuously revolved around its axis, which is done by passing the paper recording tape around a pulley on the coherer, so that the moving band of paper will cause a revolution of the tube; an indistinct illustration of the complete apparatus is given. The diameter of the tube should not be too small; it should contain only a few filings between the two silver discs; by a choice of the proper diameter of the tube and the pulley the proper relations can be found. Illustrations of records are given, as also a diagram of the connections of the local circuit, which is so arranged that when a call is received a bell is sounded and the paper is started in motion.

SPARK TELEGRAPHY. Strecker. Lond. "Elec.," April 8.—An abstract with some diagrams of a recent paper. He described a method in which a second relay is used, actuated by the relay in the coherer circuit, the secondary contacts of the second relay being connected to the Morse writer, which is open-circuited when the relay is receiving current and vice versa; a continuous dash is recorded, although the current in the first relay oscillates.

TRANSMITTING PICTURES.—Lond. "Elec. Eng.," April 15.—A note stating that in a Vienna paper further details are given of Szczepanik's invention (see "Digest"), together with a diagram of the connections, which is said to be unintelligible and is not reproduced. It appears that the inventor has abandoned selenium as unsatisfactory, and is now experimenting with a more sensitive compound of his own. The note prophecies that it will be found that the inventor has confined his attention to romancing to untechnical reporters.

INDUCTANCE IN TELEPHONY. Moon. Lond. "Elec. Rev.," April 15.—The first part of an article in which he proposes to deal with the inductance apart from the capacity, as the effects of a disturbed capacity are impossible to calculate. He describes how the inductance of a piece of apparatus may be measured by Maxwell's method. A list is given of the inductances for telephonic currents of the various pieces of apparatus used; that of the Bell telephone of 150 ohms, for instance, being 0.1 henry; a telephone transformer of 200 ohms each coil has 3.5 henrys; a switchboard telephone of 75 ohms, 0.01 henry. Formulas are given for calculating the impedance of single and shunted circuits.

TELEPHONE WORK. Dobbs. "Elec. Eng.," April 28.—In this continuation of his long serial he gives illustrated descriptions of guys, braces, etc., for the pole line.

TELEPHONE SITUATION IN ENGLAND.—"West. Elec.," April 23.—An account of the controversy in the British House of Commons over the telephone service in Great Britain.

GLASGOW TELEPHONE INVESTIGATION.—"Elec. Eng'ing," April 15.—Some of the conclusions from the report of the findings of the recent Inquiry.

TELEGRAPH RECORDING REGISTER.—"Elec. Rev.," April 27.—A short article on the first one used, which has just been acquired by the Cornell University.

DETROIT TELEPHONE COMPANY.—"Elec. Eng'ing," April 15.—The continuation of the long article on this company.

INDEPENDENT TOLL LINE SYSTEMS. Mark. "Elec. Eng'ing," March 1.—A continuation of the article noticed in the "Digest," January 22.

Miscellaneous.

ELECTRICAL INDUSTRY IN AUSTRIA. Bondy. "Zeit. fuer Elek.," April 3.—A short article chiefly of local interest, making comparisons with the industry in that country as compared chiefly with Germany.

SUBMARINE MINES.—"El'ty," April 27.—An editorial describing the first experiment in the application of electricity to submarine mines, which was made by Colt in 1842; the experiments were made for the Government, and were successful.

Exhibits at the New York Electrical Exhibition.

The following is a brief description of the exhibits at the Electrical Exhibition which opened at Madison Square Garden on Monday night last:

THE FUEL ECONOMIZER COMPANY, of Matteawan, N. Y., is exhibiting one of its 150-hp economizers, set up complete.

THE AMERICAN MUTOSCOPE COMPANY has an exhibit of mutoscopes, showing moving pictures of scientific, comic and war subjects.

MESSRS. KAUFMAN & ALEXANDRE, 1133 Broadway, New York, make an exhibit of the Cosmoramoscope, which is claimed to be the latest and best picture machine.

THE ARMINGTON & SIMS COMPANY, Providence, R. I., will furnish one of its 13 x 12 "1898 pattern" engines to be direct connected to a 50-kw Walker generator.

THE CROWN WOVEN WIRE BRUSH COMPANY, Salem, Mass., has an exhibit of samples of woven-wire brushes, under the supervision of Messrs. H. B. Coho & Co.

THE MERGENTHALER LINOTYPE COMPANY, New York, has one of its linotype machines in operation. Approximately 5000 of these machines are in use in America.

THE SIMONDS MANUFACTURING COMPANY, Pittsburg, Pa., exhibits a line of steel gears, pinions and bearings under the charge of Mr. Elmer P. Morris, New York.

MESSRS. J. H. WILLIAMS & CO., 9-31 Richards Street, Brooklyn, N. Y., will show their standard and special drop forgings, such as are used by electrical concerns generally.

THE VACUUM OIL COMPANY, Rochester, N. Y., will have on exhibition lubricating oils, such as it supplies in all parts of the world to electric light and railway stations.

MR. J. P. WILLIAMS, 39-41 Cortlandt Street, New York, will exhibit all styles of electric fans and small power motors and dynamos, showing their application to various uses.

THE NOWOTNY ELECTRIC COMPANY, Cincinnati, Ohio, has an exhibit of its well-known lamps, including a new lamp, which has just been brought out by the company.

THE NATIONAL PHONOGRAPH COMPANY will show a full line of phonographs, including the new Edison standard phonograph, which is just being placed upon the market.

THE HOPE ELECTRIC APPLIANCE COMPANY, Providence, R. I., has an exhibit of its instantaneous make-and-break safety knife switches, in charge of Mr. H. B. Kirkland, of New York.

THE NATIONAL PHOTOGRAPH MACHINE COMPANY has one of its automatic photograph machines for taking ferrotypes. The pictures can be taken day or night by the aid of electric light.

THE ARMORITE INTERIOR CONDUIT COMPANY, New York, will exhibit a full line of its products, which consist of its insulated Armorite interior conduit as well as armor duct enamel tubing.

THE ELLIOTT & HATCH BOOK TYPEWRITER COMPANY, 253 Broadway, New York, has an exhibit of book typewriters in operation.

MESSRS. L. KATZENSTEIN & CO., 357 West Street, New York, will exhibit metallic packing for piston rods, valve stems, etc.; flexible tubular metallic packing, improved slip joints and metallic gaskets.

THE ELECTRIC VEHICLE COMPANY, 1684 Broadway, New York, expects to have one of its new electric hansoms on exhibition about May 10. The company is also making preparations for an electric cab service for patrons of the exhibition.

CLEVELAND TWIST DRILL COMPANY, Cleveland, Ohio, displays in a show case samples of drills, reamers, electricians' bits, and, in fact, everything in its line of manufacture. The exhibit is made by the New York office, 99 Reade Street.

THE HARING STEAM-PLANT EQUIPMENT COMPANY, 141 Broadway, New York, represents the Armington & Sims Company at the exhibition with a 13 x 12 inch cylinder standard engine, direct connected to a Walker 50-kw lighting generator.

THE AMERICAN PULLEY COMPANY, Philadelphia, Pa., will be represented in the exhibit of the Niles Tool Works Company, 136 Liberty Street, New York, by a line of pulleys. The Niles Company will have charge of this section of the exhibit.

THE JOHN STEPHENSON COMPANY, New York, will exhibit a model car, one-quarter size, showing a full working model of the standard car used by the Metropolitan Street Railway Company of New York on its underground conduit system; also a standard car in operation.

THE PECKHAM MOTOR TRUCK & WHEEL COMPANY, 26 Cortlandt Street, New York, has an exhibit of one of its Metropolitan special trucks under a Stephenson car; also one of its new "Swing Bolster" maximum traction trucks and one "Swing Bolster" short wheel base truck.

THE NEW YORK SAFETY STEAM POWER COMPANY, 30 Cortlandt Street, New York, exhibits a 13 x 12 vertical automatic engine, direct connected to a Fort Wayne generator. This engine is one of the latest improved, designed for heavy duty and especially adapted for electrical work.

ONONDAGA DYNAMO COMPANY, Syracuse, N. Y., exhibits a 75-kw generator, direct connected to a tandem-compound Fischer engine. The generator is fitted with reacted carbon brushes. Messrs. Fairchild & Sumner, 39 Cortlandt Street, New York, represent the Onondaga Dynamo Company.

THE BOSSERT ELECTRIC CONSTRUCTION COMPANY, Utica, N. Y., intends to exhibit a complete line of boxes of all kinds for use in connection with conduit installation. The exhibit will include steel-drawn wall outlets and switch boxes, and steel-armored junction and distribution boxes of various types.

THE WARREN ELECTRIC & SPECIALTY COMPANY, Warren, Ohio, is represented by Mr. Elmer P. Morris, and its line of exhibits is more particularly described in connection with Mr. Morris' general exhibit. This company's interest wil be looked after by Mr. J. W. Holloway, one of the directors of the company.

MESSRS. BENJAMIN F. KELLEY & SON, 91 Liberty Street, New York, have connected up and running one of their Kelley patent improved Berryman feed water heaters and purifers. This firm also makes the old style Berryman feed water heater and purifier and the Standard feed water heater; also the "Economical" pump.

THE HARRISON SAFETY BOILER WORKS, Germantown Junction, Philadelphia, Pa., will exhibit a 350-hp Cochrane feed water heater and purifier; one 6-inch horizontal and one 6-inch vertical new high pressure pattern Cochrane steam separators. The heater will be so arranged that its internal construction will be readily visible.

MR. J. H. WILDAY, 23 Duane Street, New York City, exhibits the Wilday electrical engraving machine. By this machine a name can be engraved on metal of any kind in fifteen seconds, as against thirty minutes by the old method. The machine can be run from storage batteries or by current taken direct from an incandescent circuit.

THE FISCHER FOUNDRY & MACHINE COMPANY, Pittsburg, Pa., has arranged with Messrs. Porter & Remsen, 39 Cortlandt Street, New York, to exhibit a 125-hp Fischer four-valve, automatic, tandem-compound self-oiling high-speed engine, direct connected to a 75-kw Onondaga dynamo. The engine is to run at a speed of 275 r. p. m.

THE NATIONAL CARBON COMPANY, Cleveland, Ohio, will exhibit a full line of battery cells for all classes of service; electric light carbons, carbon brushes, smelting electrodes, carbon specialties for telephones, etc. Among the articles to be exhibited will be back plates, diaphragms, granular and globular carbon, lightning arrester plates, etc., etc.

THE O. S. PLATT MANUFACTURING COMPANY, Bridgeport, Conn., has an exhibit of double-pole snap switches from 5 to 100 amperes capacity; flush-lock switches, double and single pole push button switches, three-way and 500-volt switches, knife switches for motors, etc., and knife switches for lighting, ranging from the baby size to 1000 amperes.

THE PARTRIDGE CARBON COMPANY, Sandusky, Ohio, manufacturer of motor, generator and dynamo brushes, has a neat exhibit. Mr. Partridge, the manager of the company, will be in attendance for the first week or two to show the trade the merits of the company's self lubricating motor and generator brushes, which are well known the world over.

MR. THOMAS A. EDISON, JR.'S exhibit will consist of eighteen circles of lamps, the largest diameter to be 12 feet, each circle to be connected separately, so that it can be tested on the premises. The circles will be of different voltages, wattage and candle power. A wattmeter, voltmeter and photometer and other appliances will be available to test the lamps.

THE BORNE, SCRYMSER COMPANY, 80 and 81 South Street, New York City, has no special exhibit, but its interests will be looked after at the exhibition by several competent representatives who will be in attendance. This company does a large business with electric generating concerns, and makes a specialty of supplying oils for their varied requirements.

THE AMERICAN ELECTRICAL MAINTENANCE COMPANY, 451 and 453 Greenwich Street, New York, will exemplify its methods of repairing and maintaining electric plants and exhibit brushes and parts manufactured by it. It will also have a working exhibit of the "Cummings Patent Turning Tool," which the company has arranged to manufacture and sell.

PERU ELECTRIC MANFACTURING COMPANY, Peru, Ind., exhibits a full line of porcelain cut outs of all kinds: Peru style branches and mains; S. M. style branches and mains; Edison style branches and mains; multiple tablet boards; Peru transformer fuse plugs; high potential insulator, and all styles of insulators and cleats, beside Peru, Hercules and Laclede batteries.

THE BARROWS VEHICLE COMPANY, 302 West Fifty-third Street, New York, will exhibit one No. 1 Barrows electric carriage, equipped with twenty five-plate storage battery cells and 1-hp motor. The weight of this carriage is only 650 pounds. A No. 2 Barrows electric carriage, equipped with thirty-two seven-plate cells and 1¼-hp motor will also be shown. This outfit weighs 1250 pounds.

THE CARD ELECTRIC COMPANY, Mansfield, Ohio, is preparing an exhibit consisting of one 25-hp "S" type 110-volt motor; one 3-hp "E" type 110-volt motor and one 12½-kw "E" type 112-volt dynamo. These machines will have with them the necessary apparatus for operation consisting of Card automatic safety and limit switches for the motors and field regulating rheostats for the dynamo.

THE NEW BRITAIN MACHINE COMPANY, New Britain, Conn., has two engines, one of 8 horse-power, direct connected to a C & C generator; the other of 25 horse-power, coupled to a Lundell dynamo. These exhibits are under the auspices of the electrical companies in each case. The F. M. Pierce Engineering Company is the New York representative of th New Britain Machine Company.

THE BOSTON BLOWER COMPANY'S exhibit is included with that of the Kensington Engine Works, Limited, of Philadelphia. The Blower Company's exhibit consists of a 90-inch top horizontal, full housing exhauster, with a direct connected 6 x 6 vertical engine. The machine is to be used in connection with the Beckman system of forced draft, for furnishing the blast under Babcock & Wilcox boilers.

THE KEUFFEL & ESSER COMPANY, 127 Fulton Street, New York, will exhibit a line of drawing materials and instruments and of surveying instruments. Special attention will be given to measuring instruments, such as slide rules, protractors, etc., which are used largely by electrical engineers. The exhibit of drawing instruments proper and of drawing and blue printing papers, etc., will be very complate.

THE R. THOMAS & SONS COMPANY, East Liverpool, Ohio, has an exhibit consisting of a line of high-voltage insulators, covered by its patents of March 8 and March 22, this year. Testing apparatus for these insulators will be in operation during the exhibition season. The company expects to show a small press and die, illustrating the process of manufacturing porcelain for electrical purposes.

KENSINGTON ENGINE WORK, 704 Arch Street, Philadelphia, Pa., exhibits the Beckman system automatic control undergrate mechanical draft, which is manufactured by this company. The draft furnishes the air supply for the two 260-hp Babcock & Wilcox boilers. The system was described in the article on the Ellicott Square Building, in Buffalo, N. Y., published in The Electrical World of April 30.

THE BERLIN IRON BRIDGE COMPANY, East Berlin, Conn., makes an exhibit of a building 16 feet square, the roof of which is covered with the company's patent anti-condensation corrugated iron-roof covering, which is recommended for electric light and power stations, requiring a roof absolutely fireproof, and which will not condense moisture on the under side no matter what are the changes of the temperature.

THE SAMSON CORDAGE WORKS, 115 Congress Street, Boston, Mass., has a show case near one of the main flights of stairs, containing sample coils of "Samson Spot" arc lamp cord, trolley cord, bell cord, couplings, etc. Much unnecessary cost has been entailed by electric companies by the use of inferior goods for trolley cord and arc-lamp cord, and the managers of such concerns will be interested in this particular exhibit.

MR. H. J. SMITH, of Pompton, N. J., one of the best-known experts in the world in submarine explosives, mines, etc., has tendered his services to the exhibition management for the demonstration in a special tank of the manner in which harbors are protected, ships blown up, etc., and some of his ingenious apparatus for carrying on this class of work is on exhibition by Mr. Charles McLaughlin, of the firm of J. H. Bunnell & Co., New York.

THE EDISON MANUFACTURING COMPANY, Broadway and Twenty-sixth Street, New York, will exhibit the new Edison ironclad battery fan outfit and the 9-inch battery fan outfit. It will also show a full line of Edison-Lalande batteries, the Edison direct current cautery transformer, Edison alternating current cautery transformer, Edison sinusoidal machine for electro-therapeutic work, Edison electric centrifuge and a number of other specialties.

THE POPE MANUFACTURING COMPANY, Hartford, Conn., has made arrangements to give those interested full opportunity to test in actual operation one of its electric vehicles, which the company will keep in New York in addition to those shown at the exposition, for the express purpose of running in the streets, and illustrating its capabilities in actual service. One Mark III single seated and one Mark IV two seated Columbia motor carriages will be shown at the Garden.

THE GARVIN MACHINE COMPANY, Spring and Varick Streets, New York, will exhibit a very ingenious and improved twist drill grinder; also sev-

eral small tools. It will distribute circulars describing its large line of tools which are carried in stock at its store. The exhibit will be rather confined owing to the large amount of space that would be needed to display the company's standard lines of milling machines, lathes, planers, shapers, drill presses, grinders, etc.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., will have in operation a battery of chloride accumulators acting as a regulator on a varying load with wide fluctuations; also two battery tanks, one being the largest used at the last Electrical Exhibition, and the other said to be the largest in use at the present time. The exhibit will include a fully equipped electric launch; the chloride accumulator in electroplating and welding work; in portable form, etc.

THE BAYLIS COMPANY, 99 Cedar Street, New York, will have an exhibit of a 30-hp vertical, double cylinder Nash gas engine, direct connected to a generator. It will be in operation, and will supply a portion of the electric light used in the Garden. There will also be exhibited a 3-hp vertical Nash gas engine, showing the design of engines of smaller capacities. The exhibit will be in the name of the National Meter Company, in which the Baylis Company will co-operate.

THE FARIES MANUFACTURING COMPANY, Decatur, Ill., has an exhibit under the supervision of Mr. A. W. Koenig, the New York manager, consisting of a general line of goods manufactured by this company, such as Universal electric lamp holders and aluminum and steel lamp shades; also its fire and water tube boiler cleaner. The exhibit is located on the Twenty-seventh Street side on the promenade, adjoining the booth of the New York Telephone Company.

THE CROCKER-WHEELER ELECTRIC COMPANY, 39-41 Cortlandt Street, New York, has an exhibit of a representative line of its apparatus. There are shown one 150-kw direct connected dynamo, without engine; one 1-2-100 direct motor, one 80-kw belted dynamo, one 35-hp motor, one 25-hp, one 15, one 10, one 3 and one 1; one size-3 motor dynamo, one size-5 dynamotor, one size-1 dynamotor, one size-one-fourth dynamotor, and one size-14 mill motor, with controller and resistance.

THE NEW YORK CAR WHEEL WORKS, New York City, exhibits a very general assortment of wheels for street railway service, including its interurban wheel, which is especially designed to meet high-speed requirements. Wheels are displayed loose and also fitted to the company's special cold-rolled axles, of which several sizes are shown. Among the wheels exhibited are the Bemis, the Brill, the Peckham Interurban, the Broadway Standard, maximum traction and transfer table wheels.

THE AMERICAN ENGINE COMPANY, Bound Brook, N. J., makes a display of a 25-kw direct connected plant, in which one of the new American Ball engines is combined with one of the company's new six-pole generators. The current from this plant will be used for illuminating signs and general lighting purposes; also for driving one of the company's small multipolar motors, thus illustrating a complete plant for generating electric current and showing its application both for light and power.

THE CUTTER ELECTRICAL & MANUFACTURING COMPANY, Philadelphia, Pa., is represented at the exhibition by Mr. H. B. Kirkland, the New York agent. Mr. Kirkland has an exhibit of Cutter circuit breakers and flush switches. He will also show rheostats manufactured by Charles Wirt, quick-break switches, and arc cut outs manufactured by the Hope Electric Appliance Company, and conduits manufactured by the American Circular Loom Company and the Boston Electroduct Company.

THE ZIEGLER ELECTRIC COMPANY, Boston, Mass., occupies a prominent space, and displays its new angle focusing arc light for theatrical, photogravure, searchlight and stereopticon purposes; also its new direct and alternating enclosed arc lamps and some samples of its testing and measuring instruments, together with its special electrical school apparatus. This company's new focusing lamp will be used in several conspicuous places in the Garden, as well as in the lighting of the tower and roof.

THE NONPAREIL CORK MANUFACTURING COMPANY, Chambers Street and West Broadway, New York, makes a display of electrical insulators for rails, wires, etc.; sectional insulation covering for steam, refrigerator and water pipes; friction clutch blocks, and many other products turned out from its Bridgeport factory. The sheet cork insulation of this company is used for heat, cold, sound and the beds of high-speed engines and heavy machinery. This company manufactures a large line of materials of this class.

THE BULLOCK ELECTRIC MANUFACTURING COMPANY, Cincinnati, Ohio, shows one of its 25-kw engine-type generators; also one 25-kw belt generator, one 10-hp type "N" enclosed motor, one 7½-hp type "H" standard motor and one type "T" controller. The controller is from a recent design, and the 10-hp type "N" motor is an absolutely new design, this being the first machine turned out from the pattern. It is entirely enclosed, being dust and waterproof, and is designed for use in foundries, on cranes, pumps, etc.

MESSRS. BURHORN & GRANGER, 136 Liberty Street, New York, propose to exhibit one of their "Woodbury" improved automatic cut-off, high-speed engines, directly connected to a 25-kw Eddy multipolar generator. The engine will be provided with their improved automatic oiling system, and the firm expects to demonstrate by means of a tachometer and varying loads that the speed regulation of the engine, using the Shepard governor, is within one-half of 1 per cent. under all conditions in which there is sufficient steam to carry the load.

MESSRS. MACHADO & ROLLER, 203 Broadway, New York, will make a display of a full set of portable and switchboard, direct and alternating current Whitney and Hoyt instruments; a full line of A. E. G. incandescent lamps; one or two exhibition switchboards made by the W. S. Hill Electric Company, New Bedford, Mass.; a small collection of special and standard Perfection dynamo brushes made by the Ohio Electric & Specialty Manufacturing Company, Troy, Ohio; and some sample elements of storage batteries made by the Ohio Storage Battery Company, Cleveland, Ohio.

THE EXCELSIOR ELECTRIC COMPANY, 198-216 Willoughby Street, Brooklyn, N. Y., will have a display consisting of an arc generator and arc lamps of the latest type; a direct connected generator of the latest type, a slow-speed, direct current motor for direct connection; incandescent dynamo, belted; arc motors; alternating current rotaries driving an Otis elevator; synchronous and single-phase alternating current motors; automatic alternating current motor driving fan; direct current rotary transformer for single, two and three-phase currents, etc. The exhibit will be in charge of Mr. Warner.

THE AMERICAN RHEOSTAT COMPANY, Milwaukee, Wis., shows one 3-hp, 500-volt automatic starter, and one 20-hp, 230-volt automatic overload starter. There will also be one 50-hp, 125-volt automatic starter, connected up with an Eddy motor. This is of the same general principle as the smaller size automatic starters, but designed for the much greater carrying capacity required. There will also be one 5-hp, 220-volt Perfection rheostat, one 2-hp, 230-volt reversible printing press controller, one 10-hp, 230-volt reversible elevator controller and one 40-kw, 125-volt rear of board field rheostat of the company's standard design.

THE WILLIAM S. HAINES COMPANY, Philadelphia, Pa., has a display of Heintz steam traps. The company is showing two radiators, one with its radiator trap connected and the other minus the trap, with thermometers attached to the radiators to show the higher temperature which can be derived by the attachment of this device. Other traps are connected on the steam line, with the outlet exposed, to show that it is possible for these traps to discharge all of the water contained in the steam line and not one particle of steam. These traps are used in connection with the pipe for the supply of steam to the different engines used in the exhibit.

THE K. & W. COMPANY, Pittsfield, Mass., shows a full line of standard lamps, together with street series, miniature and decorative lamps. An arc lamp is in operation showing the company's absolute cut-out hanger board and spark arrester. The company's several types of K. & W. fan motors are also in operation, and these, together with K. & W. dynamo brushes, commutator compound, all in complete variety, constitute the company's exhibit. The exhibit is illuminated by a sign bearing the name of the company and the name of its incandescent lamps. Mr. C. Houliston, of the New York office, is in attendance, and is welcoming all callers.

WALKER COMPANY exhibits two of its No. 20 L motors mounted on a truck; one No. 20 L motor dismantled to show construction; two No. 4-A street-car motors, mounted; one 50-kw belted alternator; one 50-kw steel lighting generator, direct connected to a Armington & Sims engine, complete with a switchboard; type "S" controllers, assembled and dismantled; a railway switchboard, complete with feeder and generator panels; ornamental arc lamps; a new Walker recording wattmeter, and a large display of photographs of the company's apparatus. There is also shown in this exhibit a complete section of the new underground conduit, with a Broadway cable car in operation.

MANHATTAN ELECTRIC STORAGE BATTERY COMPANY, 636 Broadway, New York, exhibits the Liberty electric lamp, which is an electric night light, containing a small clock in the base of a small "Statue of Liberty." Inside of the base is a chloride accumulator having a capacity of from five to six ampere hours. The object is turn on the light at any hour of the night when required. It does away with the burning of a small light all night. The reflector is so adjusted that it can be turned in any direction; also to turn the light down on the clock. It is an ornament, and can be used for a banquet lamp by taking off the reflector. The lamp is an exact model of the Statue of Liberty, and is made in the latest shades.

THE SILEX INSULATION COMPANY, 39 Cortlandt Street, New York, will exhibit the application of a new principle in insulation in what is called the "Three Eye Conduit." This consists of an outer steel and an inner brass tube, between which is packed Silex insulation, kept in place by mica plugs, thus presenting perfectly insulated ends. The material is impervious to water; of a dielectric strength sufficient to withstand high voltages, and such a poor conductor as to prevent the smallest current from even stealing or leaking through it. The "Three-Eye Conduit" is claimed to be an indestructible, incombustible and insulated conduit, for the reason that there is nothing that enters into its construction but metals and insulating minerals.

MESSRS. F. A. LA ROCHE & CO., 652 Hudson Street, New York, have an exhibit under the firm name of F. A. La Roche & Co. and Ideal Electric Corporation, Consolidated. The exhibit includes the main building switchboard, which is located in the basement. This board was manufactured and furnished by this concern. On the main floor the company has a booth in which are shown alternating current generators of various sizes, rotary transformers and all kinds of alternating apparatus, complete switchboards, a full line of arc lamps and a large marble slab containing all sizes of the Ideal automatic circuit breakers in operation. In addition to these are exhibited the company's quick break switches, as well as its ordinary hard-drawn copper switches, panel boards and a number of other special apparatus.

HENRY R. WORTHINGTON'S exhibit will cover a space of 1000 square feet. It will be located in the centre of the hall directly opposite the main entrance. There will be shown in operation a number of different designs of small electric pumps suitable for office buildings, apartments, etc., together with the latest designs of automatic rheostats, controllers and other electrical apparatus which pertain to electric pumping. Then different types of larger electric pumps, combined with electric motors and suitable for hydraulic elevator service, mine service, boiler feed, etc., will be exhibited. An automatically controlled worm-geared elevator pump, driven by a 50-hp General Electric motor, also a Standard horizontal triplex electric mine pump, driven by a 75-hp motor will also form part of the exhibit.

MESSRS. J. JONES & SONS, 67 Cortlandt Street, New York, show a line of general electrical supplies, giving prominence to those goods of which they

are the manufacturers. A switchboard containing different switches of the firm's make is shown as a sample of a thoroughly up-to-date board. The firm's electric time cut-off switch and a row of panel boards of different styles are also shown. At the rear of the space is an exhibition board showing the different makes of bracket switches, small switches, etc., produced by this firm, and on a counter are displayed different electrical portables a quantity of heating apparatus which the firm is handling, together with medical battery apparatus. alarm clocks, etc., are also exhibited. A new arc lamp, which Messrs. Jones & Sons will put on the market at an early day is on view.

MR. ELMER P. MORRIS, 15 Cortlandt Street, New York, represents several concerns, and exhibits machines of the Card Electric Company, Mansfield; instruments of the Keystone Electrical Instrument Company, Philadelphia; gears and pinions of the Simonds Manufacturing Company, Pittsburg; Garton arresters of the Garton Daniels Electric Company, Keokuk, Ia.; the Cosmic oil filter, lamps of the Warren Electric & Specialty Company, Warren, Ohio; switchboards and switchboard fittings of the Technic Electric Works, Philadelphia; soldering compound manufactured by the Highland Electro-Chemical Company, Connellsville, Pa.; bonds, commutators, etc., manufactured by the Forest City Electric Company, Cleveland, beside a full line of railway material, of which Mr. Morris makes a specialty, including Monarch insulating paint.

THE KEYSTONE ELECTRICAL INSTRUMENT COMPANY, Philadelphia, Pa., exhibits a slate switchboard, on which are mounted a type "K" illuminated dial and a pair of type "R" instruments. Besides these are exhibited one of the company's potential indicators, an arc lighting voltmeter and a ground detector, and a ground detector for constant potential circuits. The company's line of portable instruments is also shown. This includes voltmeters for direct current only and voltmeters for use on direct and alternating current. A pair of type "R" instruments is shown in practical operation on a switchboard, which is used in connection with a dynamo and motor exhibition. The exhibit is in charge of Mr. Elmer P. Morris, and Mr. J. F. Stevens, president of the company, will spend considerable time at the Garden during the season.

MESSRS. H. B. COHO & CO., St. Paul Building, New York, occupy a space on the main aisle on the Twenty-seventh Street side. The exhibit includes Eddy generators, motors and electro-platers; a self-contained 75-kw alternator, manufactured by the Warren Electric Manufacturing Company, Sandusky, Ohio; rheostats, controllers, etc., of the American Rheostat Company, Milwaukee, Wis.; dynamos and motor brushes of the Crown Woven Brush Company, Salem, Mass.; a 15-hp, direct-connected engine of Van Horn-Burger & Co., Dayton, Ohio; translucent material, manufactured by the Translucent Fabric Company, Quincy, Mass.; electric elevators and hoists, manufactured by the Otis Electric Company, New York; telephones of the Pennsylvania Electric Company, Philadelphia, Pa., and Crescent ceiling, column and desk fans, of the Marietta Manufacturing Company, Marietta, Pa.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., is represented by an exhibit which shows the various styles of its automatic magnetic circuit breakers in sizes from a few amperes up to 2000-ampere. A variety of styles of automatic rheostats is also exhibited. An especially interesting feature of the exhibit is a new type of underload and overload rheostat, which is known as the "S. K" type, and which has many novel features. The compact size and simplicity of this device and its reported reliability in action will commend it to the electrical trade. The Ward Leonard Company also exhibits various forms of the Carpenter enamel field rheostats, also a large variety of the porcelain lined outlet boxes and switch boxes, etc., which are largely used in high grade wire installations in New York City. A novel and neat style of rheostat for small ventilating fans attracts a great deal of attention on account of its compactness.

THE MONARCH MANUFACTURING COMPANY, 39 Cortlandt Street, New York, expects to exhibit several engine stops and speed limits. One pair of these apparatus will be mounted on a table in connection with an engine throttle valve. The engine stop will be connected so that by pressing any of the several buttons placed at convenient points the valve will be closed inside of five seconds. In order to make the demonstration plain to visitors the company will mount a church organ pipe on top of the valve, while below the valve will be connected with piping to a Sturtevant blower operated by an electric motor. When the fan is running and the engine stop valve is open a note will be sounded from the organ pipe, but the moment the valve is closed the sound will cease. The company's speed limit will be operated direct from a second electric motor, the speed of which will be controlled by a rheostat. This will be an interesting exhibit to steam engine users.

MESSRS. ZIMDARS & HUNT, 127 Fifth Avenue, New York, make an interesting exhibit of electric light and power specialties, such as knife switches, panel, feeder and connection boards; automatic switches and motor starters; connections, bar work, lugs, etc. All types of Zimdars & Hunt's "all copper" knife switches, in single, double and quick-break, are shown in connection with the drawn copper back connections lately introduced by the firm. Three types of this firm's improved voltmeter and galvanometer switches are also exhibited. The panel and feeder board exhibit is very attractive, and shows the latest and most approved practice in this line. Among the many articles of merit shown by the firm may be mentioned an assembled wall plug and receptacle, this being the first exhibition of this device. A novel feature of the exhibit is a complete bar copper railing at the front of the booth representing switchboard bar work.

THE MONTAUK MULTIPHASE CABLE COMPANY, 100 Broadway, New York, has a booth in the northeastern section of the Garden, where it has an exhibit of its new automatic thermostatic interior electric cable. These cables are used for all interior electrical work, such as electric bells, electric gas lighting, electric fire and burglar alarm, telephone and telegraph work and even for electric lighting. In this system power is given to every wire, for whatever purpose used, to discover dangerous heat or flame in existence in the vicinity of the cable, and to notify existence of the same at any and all points desired, both locally and at a central station. The company makes an exhibit of both local and central stations, the latter being connected with the telephone, district service boxes, thermostatic devices, auxiliary fire alarm boxes and all other transmitting devices. The Montauk Multiphase Cable Company claims that it is the only manufacturer in the world of automatic thermostatic electric cables. It is bringing out at the exhibition all the salient points of its system..

MANNING, MAXWELL & MOORE, 111 and 113 Liberty Street, New York, represent the Ashcroft Manufacturing Company, the Consolidated Safety Valve Company and the Hayden & Derby Manufacturing Company. The Ashcroft exhibit comprises pressure and vacuum gauges; screw-test pump and gauge, Edson recording gauges, Ashcroft safety recorders, Tabor indicators for steam engines and gas engines, Coffin averaging instrument and other products of this concern. The boilers supplying steam for the Electrical Exposition are fitted with the Ashcroft steam gauges. The exhibit of the Consolidated Safety Valve Company includes Richardson-Ashcroft solid nickel-seated pop safety valves, and Richardson patent shifting and water relief valves. The steam boilers at the exhibit are fitted with Consolidated safety valves. For the Hayden & Derby Manufacturing Company, Messrs. Manning, Maxwell & Moore exhibit automatic indicators, H-D noiseless water heaters and many other devices manufactured by this company. The exposition steam boilers are supplied with water by Metropolitan double-tube injectors, which are of the same type used at the Electrical Exposition in 1896.

MESSRS. OTIS BROTHERS & CO., 36 Park Row, New York, show in their exhibit an interesting electrical appliance, consisting of a model of their house elevator operated by a push button device. The movement of the car is controlled electrically by means of a button placed in each hall near the elevator shaft, and the car is brought to the floor at which the button is pushed, provided all doors leading to the elevator shaft are closed, and no door in the shaft can be opened unless the car is opposite the landing at which it is desired to open the door. Inside the car are placed several buttons, by pressing which the occupant can bring the car to the desired landing, each button being numbered to correspond to the floor to which it will bring the car, and when the car arrives at such floor it will automatically stop. The buttons in the car are also inoperative if any door in the shaft is open. In addition to this they exhibit one of their standard electric engines in operation. One of these engines is shown in connection with the exhibit of the Excelsior Electric Company, of Brooklyn, and is operated by a Churchward transformer.

C & C ELECTRIC COMPANY, New York, has one of the most interesting exhibits in the building. In the basement is an operative exhibit, which includes a C & C multipolar generator directly connected to a 25-hp Diesel rational heat motor. This is the first Diesel motor shown in this country. On the main floor of the building the C & C Company has an exhibit occupying 500 square feet of space. The apparatus here shown includes the company's latest types of bi-polar dynamos and motors in several sizes; also a full line of its closed type iron-clad motors and dynamos. The machines of the iron-clad type are shown, some separately and some in combination with other machinery. The 20-hp enclosed iron-clad motor is shown in connection with a Lambert hoist, and one of the dynamos is directly connected to a Case engine. The exhibit also includes one of the iron clads fitted up with back gears for speed reduction. Two of the company's slow-speed, belt type generators are also shown, as well as numerous other interesting machines, appliances and parts. A C & C switchboard forms an attractive feature of each exhibit.

MESSRS. WOOD, SHAW & CO., 40 Broad Street, New York, have an extensive exhibit. As representatives of the Partridge Carbon Company, Sandusky, Ohio, they show the various kinds of self-lubricating carbon and pure plumbago dynamo and motor brushes, in addition to the Partridge Company's new arc-light carbons, which are said to be equal to the imported goods. The Quaker City Electric Company, Philadelphia, exhibits under this firm's supervision, its latest design of generators, motors, rheostats and starting boxes. Among the goods of other concerns represented by this firm are the New England snap, indicator, flush, lock and push switches, new all-copper slow and quick-break knife switches, manufactured by the O. S. Platt Manufacturing Company, Bridgeport, Conn.; the Universal non-arcing lighting arrester for light and power circuits, direct or alternating, which is manufactured by the Universal Electric Company, New York.; and a line of octagonal wooden poles, plain and treated, for electric light and power use, manufactured by A. D. French & Co., 40 Broad Street, New York; Imperial leaf and gauze dynamo brushes, manufactured under the supervision of H. M. Shaw, are also shown.

THE EDISON ELECTRIC ILLUMINATING COMPANY of New York will occupy 800 square feet of space at the right of the main entrance. The space will be divided into three sections, the central containing a structure surmounted by a dome of some height, courts occupying the ends. The dome section will be devoted to arc and incandescent lighting in various forms. Its interior will show various sizes and types of incandescent and enclosed arc lamps; miniature lamps will be shown in the arches and the done; projectors, throwing outwardly, will stand at the angles, and self-supporting "underfeed" enclosed arc lamps will be placed at uniform distances at the base of the dome. Surmounting the dome there will be a ball, 3 feet in diameter, of miniature lamps, connected by a commutating switch in rotating sections. The end space nearest the entrance will be devoted to electric heating and cooking, and such specialties as hair curlers, smoothing irons, etc., will be shown. The other court will contain an exhibition of power, showing various applications of direct connected machinery, such as is used in modern printing, for general shop purposes, house and building pumping, etc. The company's exhibit will also include its system of street lighting, as shown in the arc lamps arranged around the promenade over the arena boxes.

The Genuine Ericsson Swedish Microphone.

The instrument represented in the accompanying illustration is the genuine Ericsson Swedish coal grain microphone, which is so extensively patterned after by manufacturers throughout the United States. The Ericsson Telephone Company, 20 Warren Street, New York City, is the sole importer and agent in the United States for these instruments, and it calls attention to the fact that the genuine instrument can always be identified by the words "Made in Sweden by A. B. L. M. Ericsson & Co., Stockholm. Patented Oct. 20, 1895," appear

THE ERICSSON MICROPHONE.

at the base of the mouthpiece. The many imitations of this instrument are of as nearly identical construction with the genuine as is possible to make them, but the comparison between the two in practical operation, the Ericsson Company states, is very marked, the imitation being a much inferior instrument. The genuine instruments can be obtained only from the Ericsson Telephone Company and its distributing agents.

Some New Electrical Apparatus.

After a quarter of a century's experience as manufacturer of engines, boilers and kindred machinery, the Armitage-Herschell Company, North Tonawanda, N. Y., has entered the electrical field with a line of apparatus of such merit that, with its past record and backed by its ample capital and resources, it should become an important factor in it.

Its first production was the electric elevator, shown in Fig. 1, which possesses the rather novel feature of being a strictly high duty machine in which the motor runs in but one direction. The reversal of the movement of the car is accomplished by friction gearing. Upon the worm shaft are mounted two bevel iron friction gears, either of which may be engaged with a specially prepared paper friction gear upon the motor shaft, the engagement with one iron friction gear producing the upward movement of the car and the engagement with the other the reverse movement.

Believing that the whole apparatus should be built in one shop, the next step was to bring out a suitable motor and controller. The result is the enclosed multipolar motor and auto-starter shown, the latter being entirely mechanical in action and free from magnets and dash pots. The rheostat is manipulated by a centrifugal device mounted upon the motor shaft, giving a positive control of the resistance and fulfilling the ideal requirements that the resistance be reduced as the speed rises in such a way as to give a uniform acceleration to the load.

The satisfaction which this motor and controller have given has led the company to place them upon the market, independently of the elevator. The controllers and rheostats are built in all sizes, and the motors and generators in sizes up to 50 kilowatts. The motors and generators have one-piece, cast-steel magnetic circuits, with diagonal pole pieces, which gives sparkless commutation at all loads. The armatures are slotted to receive machine-wound coils, of uniform length, thus giving a structure which is symetrical both electrically and mechanically. The method of winding is shown in Fig. 2, which represents a half finished armature in process of winding.

A unique system of rating, based upon output at a uniform speed of 1000 r. p. m. has been adopted for this apparatus. The table shows in detail the method of rating:

R = Rating, W = Watts, S = Speed, H. P. = Horse Power.
R = W/S, W = S × R, S = W/R, H. P. = S × R/746.

Rating R = W/S	Watts at 1000 R. P. M.	S = W/R. Any Speed from	W = S × R Capacity in Watts Proportionate to Speed and from	H. P. = .00134 S × R Capacity Proportionate to Speed and from	H. P. at 1000 R. P. M.
1-16 B. P.	66	1000 - 3000	66 - 138	1-12 - ¼	.09
1-8 B. P.	125	1000 - 3000	125 - 375	1-6 - ½	.16
¼ B. P.	250	1000 - 2400	250 - 600	⅓ - ¾	.33
½ B P.	500	500 - 2400	250 - 1200	⅓ - 1.5	.67
1- B. P.	1000	300 - 2000	300 - 2000	⅜ - 2.75	1.34
1- M. P.	1000	300 - 2000	300 - 2000	⅜ - 2.75	1.34
2- B. P.	2000	300 - 2000	600 - 4000	¾ - 5.5	2.68
2- M. P.	2000	300 - 2000	600 - 4000	¾ - 5.5	2.68
3- B. P	3000	300 - 2000	900 - 6000	1.25 - 8	4.00
3- M. P.	3000	300 - 2000	900 - 6000	1.25 - 8	4.00
5- B. P.	5000	300 - 2000	1500 - 10000	2. - 13.5	6.70
5- M. P.	5000	300 - 2000	1500 - 10000	2 - 13.5	6.70
7½ M. P.	7500	300 - 2000	2250 - 15000	3 - 20	10.00
10- M P.	10000	250 - 1800	2500 - 18000	3.5 - 24	13 40
15- M. P.	15000	250 - 1800	3750 - 27500	5. - 37	20.00
20- M. P.	20000	250 - 1600	5000 - 32000	6.6 - 43	26.80
25- M. P	25000	250 - 1600	6250 - 40000	8.4 - 53	33 50
30- M. P	30000	250 - 1400	7500 - 42000	10 - 56	40.00
35- M. P.	35000	250 - 1400	8750 - 43000	11.5 - 65	47.00
40- M. P.	40000	250 - 1300	10000 - 52000	13.5 - 70	53.60
45- M. P.	45000	250 - 1200	11250 - 58000	15 - 72	60.00
50- M. P.	60000	250 - 1200	12500 - 60000	16.5 - 80	67.00

The company will carry in stock machines wound for the above-named speed, together with bare armatures, to which, on short notice, may be applied the necessary winding to meet any requirements.

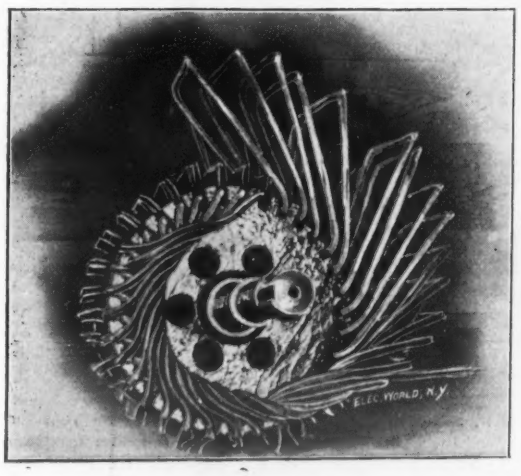


FIG. 2.—METHOD OF WINDING ARMATURE.

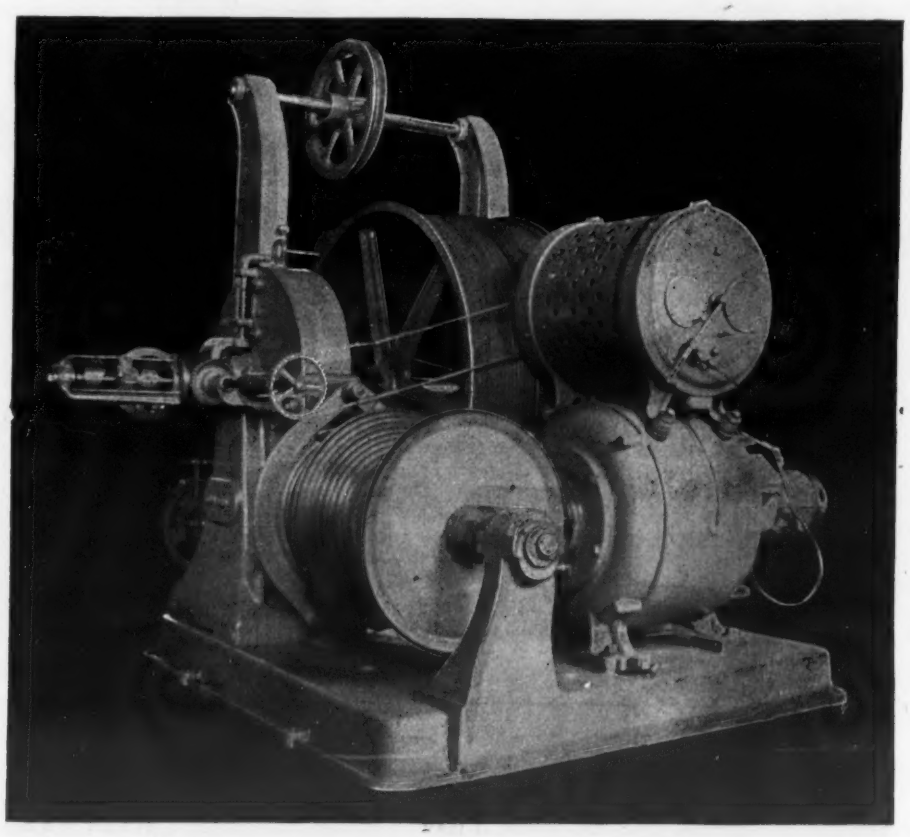


FIG 1.—ELECTRIC ELEVATOR.

Needle Lubricators.

The accompanying illustration represents the Forster needle lubricator which is handled by Messrs. Williams & Lazier, 298 Main Street, Buffalo, N. Y. The oil is fed by this lubricator in proportion to the speed and diameter of the shaft, with the same size cup. The bearing in which the speed of the shaft is 500 r. p. m. will obtain twice the oil that the same bearing would get if the speed were reduced to 250 r. p. m. Any kind of lubrication may be used effectively in this cup. Low temperatures do not stop its action. Actual trial has demonstrated that bearings exposed to the open weather are properly lubricated in the dead of winter, the steel needle conveying heat from the bearing up into the lubricant cup. It is stated that this has been demonstrated with the temperature at 10 degrees below zero. The needle does not cut the bearing, the oil preventing such action. It is stated that bearings which are usually oiled daily do not require attention oftener than once a week when equipped with these cups. The flow of oil stops with the stopping of the machinery, since the flow is produced by the vibration of the needle on the shaft. The action of the cup is positive, and there is no danger of the bearing becoming dry. Brass needles are furnished in the cups when wanted for use on electrical machinery.

A 225-kw Generator of Late Design.

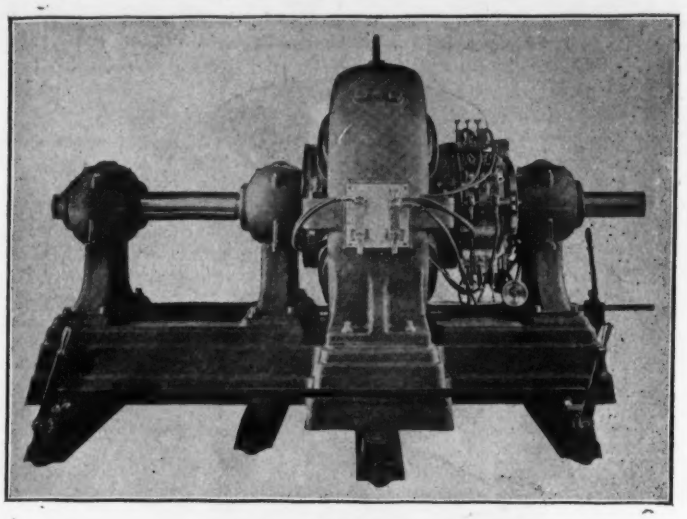
The 225-kw generator illustrated herewith is of the latest design brought out by the Card Electric Company, Mansfield, Ohio. Every part of the machine, while massive, is well proportioned and made to withstand hard work and rough usage. The armature has some special features in the way of conveniences for ready inspection and repairs, which will be appreciated by purchasers. With the winding on this armature it is possible, by unsoldering not to exceed twelve connections at the commutator, to remove any coil from it without disturbing any other coil in the body of the armature.

The provisions for uncovering the armature are both simple and effective. By means of the screw and lever on the base frame the two supporting bearings and armature are forced rearward on the base until the armature body is in the place of the pulley and the commutator completely uncovered. In this position any of the field coils can be removed. A reverse movement of the screw returns all of the parts to their proper place. With heavy windings, a large commutator and improved brush holders, this generator is specially fitted for any kind of heavy duty.

Stage Lighting Apparatus.

Comparatively few theatregoers realize the extent to which electricity is used and applied for their special entertainment. Beside the use of the ordinary electric light on and about the footboards, the necessities of the modern stage require a variety of illuminating apparatus for special purposes, and to meet these extraordinary requirements the ingenuity of the electrician finds a wide scope in the perfection of the stage setting of the modern play.

Among the manufacturers in New York City of stage lighting apparatus is the Universal Electric Stage Lighting Company, 842 Broadway, whose improved forms of apparatus are described and illustrated herewith. The apparatus as manufactured by this company is in general demand among the principal theatres of New York City, and is in general use by all the best theatrical companies playing at other theatres in the larger cities on the road. Their general reputation for economy, durability and satisfactory results has won for them the commendation of theatre managers.



225-kw Generator.

Figs. 1 and 2 show the front and side views of the Universal Company's gallery reflector, ample ventilation being provided near the front for the escape of the heat. The reflector in its general shape is parabolic, the reflecting surfaces consisting of sections of corrugated silvered glass. An improvement in this reflector consists of a removable and ventilated back, immediately behind the focal point. It is made of nickeled metal, and is fastened to a double frame at the back of the reflector. This frame provides an annular air space for the free escape of heat, thus preventing the blackening and tarnishing of the nickeled reflector. The lamp mechanism (Fig. 6) is simple. This form of lamp is used on all the stage lighting apparatus made by the company. It is so constructed that it can be used both for direct and alternating current, the use of the lamp on either current being provided for by the removal of a small wheel on the top, and placed on the bottom gear of the lamp. The location of a small wheel at top and bottom provides for the feeding of the top carbon twice as fast as the lower for direct current, or for feeding the carbon equally for alternating. The carbon holder is also adjustable horizontally, to spread the light or concentrate it, as necessity requires. The opening of the reflector is square, in order to spread the light in that form. The resistance for the lamp is fixed to a stand at the base of the supporting rod, and is shown in greater detail in Fig. 7. The frame on which the resistance wire is wound is triangular

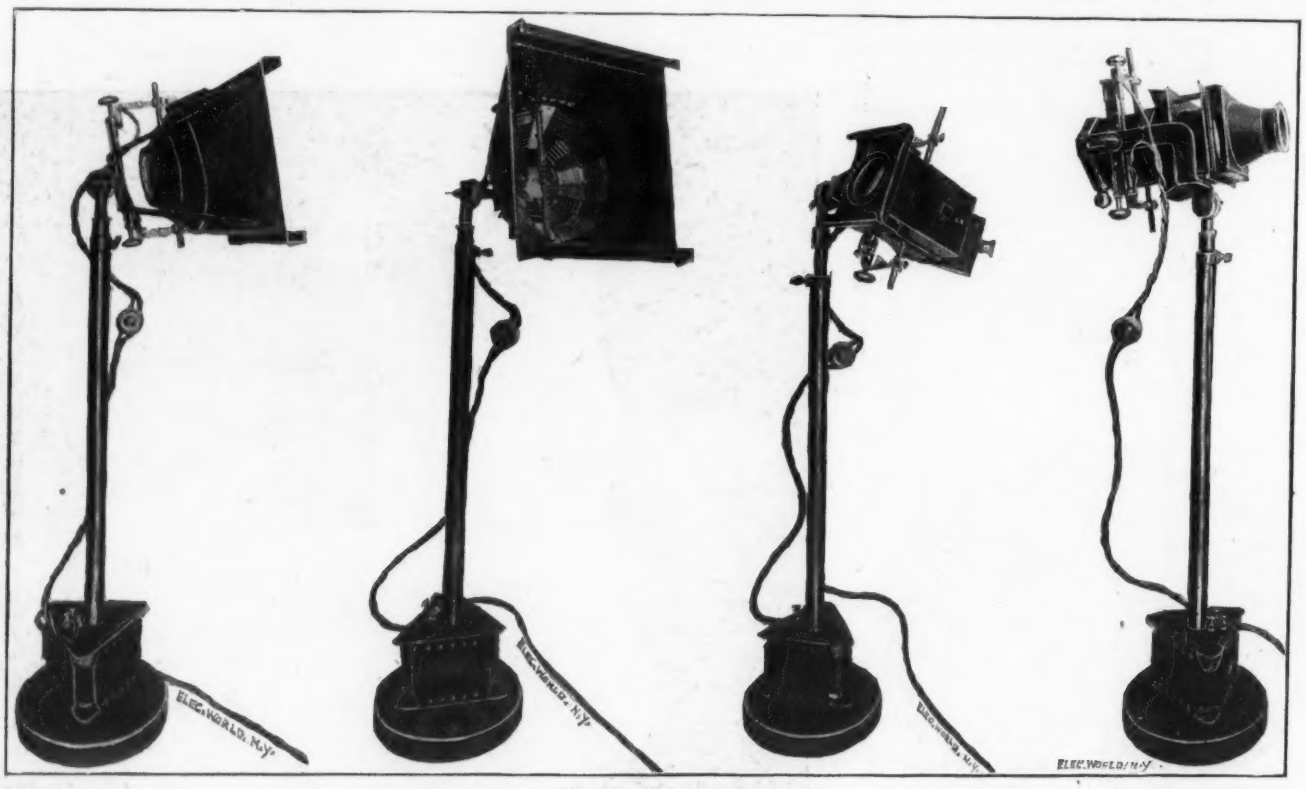


Fig. 1. Fig. 2. Fig. 4. Fig. 5.

in shape. At each angle are two porcelain tubes, and around the triangular frame thus formed Kruppina wire is wound. This wire is especially made for this class of work, and is said to have a specific resistance twice that of german silver. The rheostats are wound for alternating and direct current, 52 to 104 volts alternating and 110 direct; are well ventilated, and as the wire heats but little the temperature never attains a high degree. Three terminal posts are provided, one for each end of the wire and the third for a tap half way between the terminals. By placing the resistance box on the stand it is convenient to move the entire apparatus with the greatest ease. The lamps and boxes are interchangeable, thus rendering it practicable to use one lamp on any of the boxes made by this company.

The open box lamp (Fig. 3) is for use in wings to throw a bright light onto the stage and illuminate the scene of the play. It is especially designed and adapted for this purpose, and gives a more powerful light than the old-style calcium lights. It is lighter in construction, so that it can be handled easily and quickly. The lamp illuminates an area of 40 square feet, and its movable head enables the operator to throw the light in any direction. It is so constructed as to spread the light equally. The screens used for the open box and reflectors are of an improved form, and are made by the Universal Company. They are constructed of gauze stretched on a wooden frame, the gauze being afterward colored by a special preparation which renders it fireproof, and at the same time permitting a perfect diffusion of the light.

The lens box (Fig. 4) is perfectly light tight. To atttain a proper focus the entire carbon holder is movable backward and forward. The carbons pass in and out at the top and bottom of the box through mica to insulate them from the box itself. The lens is placed in a separate frame, and when placed in position in the box, a space around the periphery is provided for ventilation. This improvement avoids the breaking of the lenses. The lens box can be set at any angle without danger of the lens being displaced or falling out.

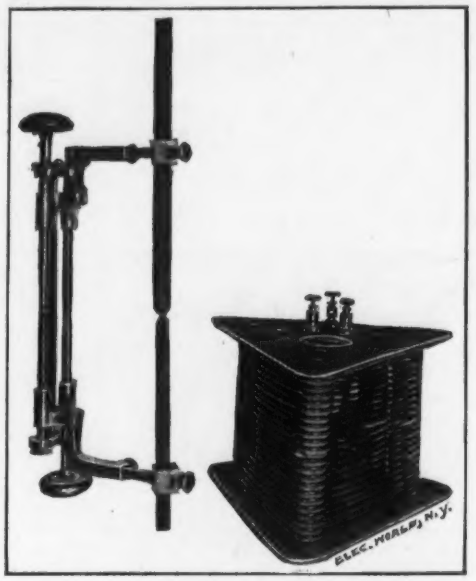
The stereopticon (Fig. 5) is used in producing various effects on the stage, such as snow, rainbow, rain, lightning, waterfall, water ripples, clouds, rising and setting sun and moon, etc. In construction it is practically the same as the lens box, and can be used as such. It is provided with a holder for the mechanical devices used in producing the different effects. The results as viewed by the audience are truly realistic, the steadiness and even working of the effects being due to clockwork movement, with which the apparatus is fitted.

Fig. 7 shows the Universal rheostat on an enlarged scale, without the iron cover. The company makes a specialty of this form of rheostat, and has many calls for it separately.

The Universal Electric Stage Lighting Company also manufactures a new patent bunch light in shape like a large funnel, with a smaller one reversed in the centre, as shown in Fig. 8. The lights are set around the smaller inverted cone in sockets, so that the light is equally distributed without black spots or shadows. These lights are for general stage illumination, and are capable, it is said, of giving twice the illuminating candle power of any other bunch light.

The company has also recently brought out an Optiscope—a movement attachable to the lens box and directed on the performer on the stage, producing an agreeable optical illusion. A very rapid succession of light rays are thrown upon the dancer by the revolving diaphragm, which has the effect of apparently multiplying the number of dancers. This is the result of the rapid succession of impressions made upon the eye. The effect is very startling, and is heightened by projecting the light through colored discs, which throw light of different colors upon the dancer.

In addition to the manufacture of apparatus for electrical theatrical purposes the company also makes outfits of miniature lamps and other fancy lights, electrical signs and interior and exterior decorations for buildings, banquets and special celebrations. Everything in the way of stage illumination and the installation of material for stage outfits is undertaken by the company.



FIGS. 6 AND 7.

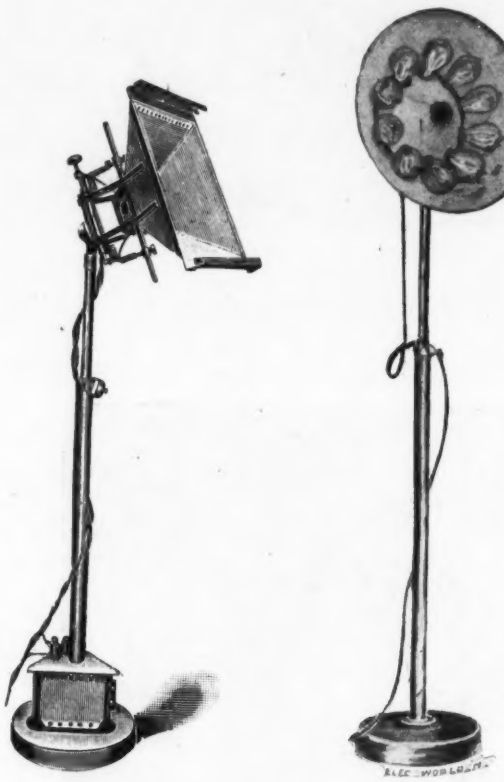


FIG. 3.

FIG. 8.

Silk Lamp Shades for Electric Lights.

The accompanying illustration shows an electric lamp shade made of silk in imitation of roses. It is underlined with crepe paper, and mounted on a 2¼-inch metal ring. It is a very effective decoration for the dining room, library, hall and theatre cosy, and gives the light in the room a very soft effect. These shades are made in fourteen stock colors, such as white, light pink, dark blue, red, cardinal, cherry, jack rose, yellow, light blue, heliotrope, Nile green, pistache green and olive green, and can be furnished in any other color from sample.

SILK LEAF AND ROSE SHADE.

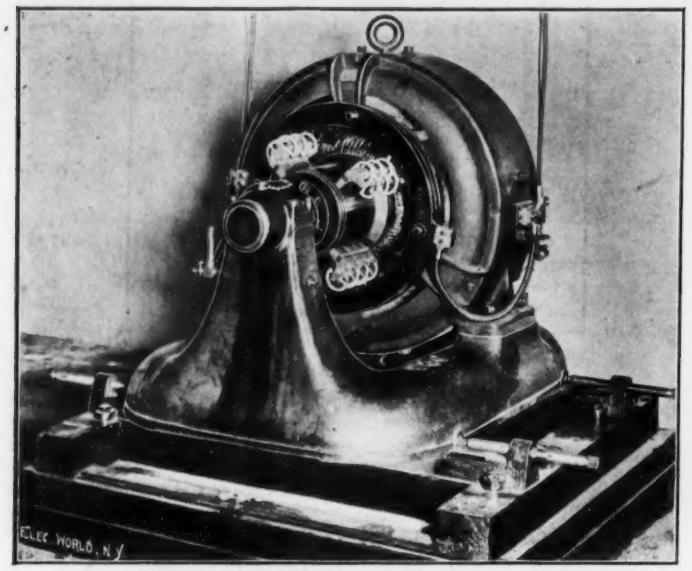
The illustration shown represents only one design of the very many shapes made by Mr. H. Hohenstein, 24 and 26 Murray Street, New York. Among other designs of lamp shades may be mentioned the dome shade, petal shade, morning glory, tulip shade and the bell shade.

Coffee Preparation by Electric Power.

A rather interesting installation of electrical machinery has recently been made by the Philadelphia branch of the C & C Electric Company in the coffee works of L. H. Parke & Co., 232 Market Street, Philadelphia. Here coffee is received in the condition in which it is picked in the fields, and is put through the various processes necessary to prepare it completely for the consumer. The works are most complete, all the handling being done by machinery, largely automatic, and this being entirely motor driven. Most of the work is done in the fifth and sixth floors of the building, and to avoid the expense of shafting and belting an isolated plant was installed. As the work is quite dusty, the enclosed type of C & C motor was adopted. The installation is laid

out for a 220-volt, two-wire service, with breakdown connection to the street mains. The generator consists of a four-pole, 220-volt, compound-wound C & C machine, belted to be driven at 450 revolutions by a horizontal engine, built by the Kensington Engine Works. The motors aggregate a capacity of about seventy horse-power. All the motors are fitted with the new C & C starting box, provided with overload and no-voltage release, and are, as a rule, belted to their loads. Four are of ten horse-power, three of seven and a half and one 5-hp reversible motor drives a Morse elevator machine.

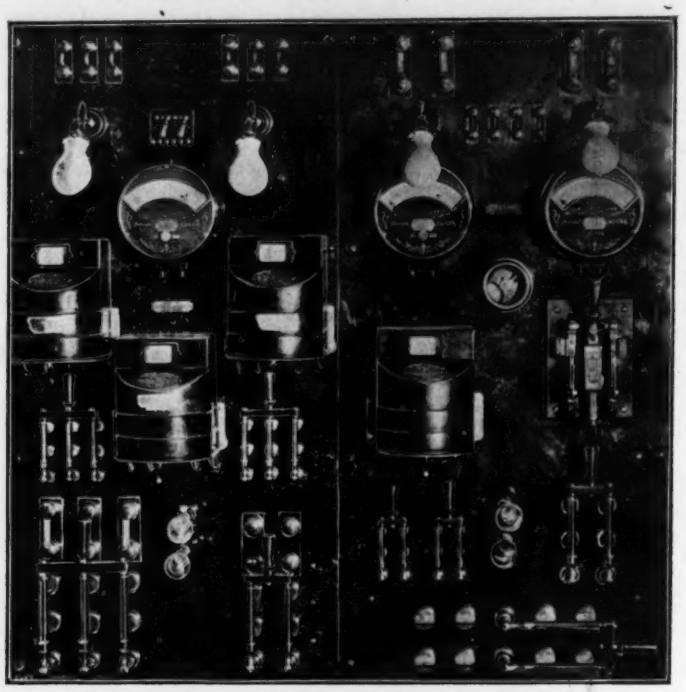
The course of the coffee through the different parts of the works is quite interesting. It is first dumped from the sacks into a hopper, from which it is picked up in a "lifting leg" by buckets mounted on an endless belt and passed into a cleaning machine. This blows a blast of air through it in such a way that all dust, chaff, etc., is sorted out. The coffee is then screened and lifted and thrown into a conveyer consisting of a trough, along which it is pushed by cleats attached to an endless belt. From this it is dropped to the hoppers of the roasting machines, of which there are fourteen. The



The Generator.

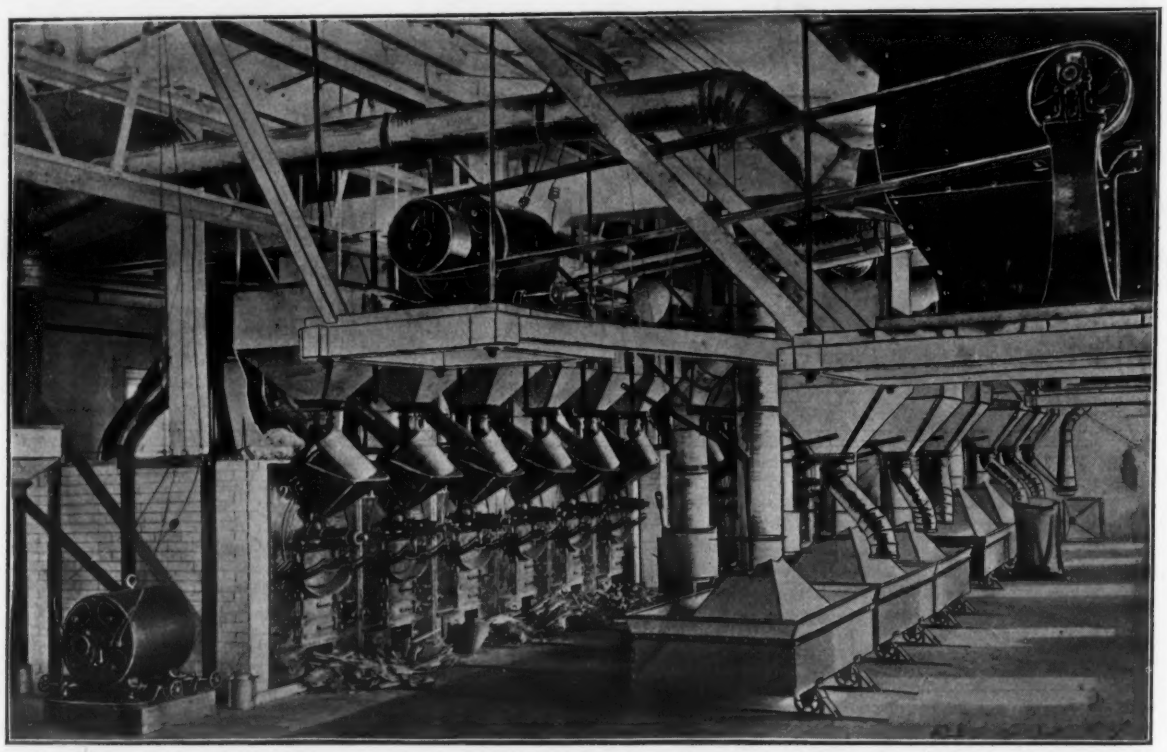
cylinders of these roasting machines are driven by bevel gears by two countershafts in line running behind them, these countershafts being clutch connected at the middle and driven at either end by 7½-hp motors. Air is sucked through the coffee as it roasts by a motor-driven Sturtevant blower, preventing it passing from them into the blower. From these the coffee is distributed downward by movable chutes into the various bins below, the arrangement being similar to that of grain elevators. On a lower floor there is a picking machine, motor driven, consisting of a canvas belt which travels slowly along, allowing foreign materials to be picked out by hand as slate is picked out of coal in the quarries. Other small motors drive automatic weighing machines by which the coffee is lowered in 1 pound or one-half pound quantities into sacks, which are deftly wrapped up and sealed by attractive appearing attendants.

The economy and flexibility of electrical transmission of power is well illustrated in this installation. The power transmission in the building now occu-



The Switchboard.

pied by L. H. Parke & Co. was formerly effected by a vertical shaft 80 feet long. The C & C Electric Company has paid a great deal of attention to power transmission, and the enclosed type motor is the result of the study of the conditions under which this class of installation is usually run. Messrs.



Motor-Driven Roasting Cylinders and Blowers.

When roasted the coffee is dumped out of the front end of the cylinders into large screens mounted on trucks. These are rolled under hoods connected also to a motor-driven blower, which draws air through the coffee, thus cooling it. The hoods are then raised, and nozzles attached to the same blower are lowered, by which the coffee itself is sucked up into overhead hoppers, screens

Parke have expressed their opinion that these conditions have been fully met.

This equipment was put in under the superintendence of Mr. William Myers, the new manager of the Philadelphia office of the C & C Electric Company. Mr. John L. Hall, formerly with the Crocker-Wheeler Electric Company, is the assistant.

NEWS OF THE WEEK

Financial Intelligence.

RUMOR ABOUT AN "ELECTRICAL TRUST."—A financial paper states that it is reported in New York that a consolidation of the diversified electrical interests is in contemplation, and that the combination will include the General Electric, the Westinghouse and the Walker Companies, with a combined capital of $100,000,000.

Special Correspondence.

NEW YORK NOTES.

Office of THE ELECTRICAL WORLD,
253 Broadway, NEW YORK, May 2, 1898.

MR. JOHN J. BAYARD, representing the Cabinet Manufacturing Company, Steubenville, Ohio, is in New York. Mr. Bayard will represent his company in this territory.

THE MACKAY-BENNETT CABLE COMPANY has been granted permission to reconstruct its subway in Brooklyn. The present subway of the company was built fourteen years ago, and was the first one laid down in Brooklyn. The old construction, which has been found to be still in a fair condition, will be entirely replaced by a more modern system of underground construction. The permit allows the company ninety days in which to complete the work. Beginning at the Brooklyn Bridge pier the subway runs along Front Street to Hudson Avenue, to Park Avenue, to Vanderbilt Avenue, to the Plaza and Flatbush Avenue, to Ocean Avenue, to Sheepshead Bay.

A TEMPORARY INJUNCTION was granted in Brooklyn on April 24 by Justice Cohen, of the Supreme Court, restraining the Edison Electric Illuminating Company of Brooklyn from absorbing the plant and franchise of the Municipal Electric Light Company. The action was brought at the instance of Mr. Thomas D. Leeman, a stockholder of the Edison Company and a resident of the Borough of Manhattan. Mr. Leeman recites that the directors of the Edison Company have made an offer to the stockholders of the Municipal Company to take their stock, for which they are to receive in return a new issue of stock in the proportion of two to one of the old stock. Mr. Leeman states that the Edison Company is now mortgaged for $1,500,000, which mortgage by its terms covers all the property that may be acquired by the Edison Company, as well as that now in its possession, and that the proposed deal with the Municipal stockholders will be in contravention of the mortgage.

THE 124TH MEETING of the American Institute of Electrical Engineers was held at 12 West Thirty-first Street on Wednesday evening, April 27, Mr. H. Ward Leonard in the chair. A paper on "An Economy Tests of Central Stations" was presented by Prof. W. E. Goldsborough, of Lafayette, Ind., also a paper on "A Novel Form of Thermo-Electric Battery," by C. J. Reed, of Philadelphia, which was accompanied by experiments. Abstracts of these papers are published on other pages in this issue. The discussion was participated in by Messrs. Cox, E. P. Thompson, Mailloux, Reed, Wintringham, Steinmetz and Mr. W. M. Mordey, of London. At a meeting of the executive committee in the afternoon the following associate members were elected: Wyatt H. Allen, 202 California Street, San Francisco, Cal.; William H. Fitzhugh, superintendent Bay City Electric plant, Bay City, Mich.; John Breckenridge Fleming, mill superintendent and constructing engineer, Austin Mining Company, Austin, Nev.; George J. Henry, Jr., engineer for New York branch of the Pelton Water Wheel Company, New York City; N. S. Hopkins, assistant engineer General Electric Company, Schenectady, N. Y.; Robert Lindsay, general superintendent the Cleveland Electric Illuminating Company, Cleveland, Ohio.; Frederick A. Muschenheim, electrical engineer, Western Electric Company, New York City; Newton L. Schloss, consulting engineer, New York City; Clarence M. Tolman, electrical engineer, with Edward G. Stoiber, Silverton, Col., and Ernest Stiles Vinten, draughtsman, Walker Company, New Haven, Conn.

NEW ENGLAND NOTE.

Branch Office of THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., April 29, 1898.

SOME INTERESTING FACTS AND FIGURES appear in a table of stockholders in the American Bell Telephone Company, published in the "Boston News Bureau." There is a total of about 6882 different holders of the 258,863 shares of the company. Mr. Theo. N. Vail, appears as the largest shareholder, having 4784 shares in his name. At the present market price of Bell Telephone stock Mr. Vail's holdings are worth $1,176,864. Mr. John E. Hudson, president of the company, owns fifteen shares. Under the Massachusetts law it is not necessary for directors to hold stock in a corporation directed by them. The thirteen directors of the Bell Company hold 4394 shares, the largest shareholder among them being Alex. Cochrane (& Co.), who own 1200 shares. Director Thomas Sanders has the lowest number of shares—twelve. Mr. George L. Bradley appears to be the only director without any holdings in the company.

BUFFALO AND NIAGARA FALLS NOTES.

BUFFALO, N. Y., April 29, 1898.

THE BUFFALO STREET RAILWAY COMPANY has its new storage batteries in operation and finds them even more serviceable than was anticipated. Though they are only of 1200-hp capacity, they readily store up enough energy to bridge over the bad morning and evening peaks completely and save the starting up of three engines, which formerly had to be used to assist the Niagara current.

THE BOUGHTON TELEPHOTOS COMPANY, of Buffalo, has received orders for several sets of its electric signaling apparatus for the United States Army, which had not ordered any before, though the Navy Department has taken so many already that the factory is running over time to make them. For a long time the invention languished, but this appears to be the inventor's opportunity.

THE BUFFALO ELECTRICAL CONTRACTORS' ASSOCIATION has been organized for the purpose of securing to its members reasonable profits for their work. The members of the association are as follows: Jaynes Electrical Company, the F. P. Little E. C. S. Company, J. C. Sterns & Co., F. P. Jones, T. H. Flach & Son, McCarthy Brothers & Ford, Charles Plumb Electrical Works, H. I. Sackett, Thebaud-Churchill Electric Company, Robertson & French Electric Company, Wilhelm Telephone Company, Herman L. Peters and Buffalo Electric Company.

THE CATARACT POWER & CONDUIT COMPANY has issued its schedule of rates in a concise form on a card, and finds that it is much more intelligible in that form than as at first given out. The engineers who made up the schedule are more than pleased over the reception of the rates, and say that all experts who have examined the schedule speak of it in most complimentary terms. It appears quite certain that the letting of contracts will be slow, as so many complications are sure to arise. Even that of the Urban mill, which was first in the field, and is owned by the president of the conduit company, still hangs fire, a hitch with the underwriters over a fire pump having developed.

PITTSBURG NOTES.

PITTSBURG, Pa., April 29, 1898.

UNITED TRACTION COMPANY'S EARNINGS.—The net earnings of the United Traction Company for nine months, ending March 31, 1898, were $483,558, as against $483,470 in 1897. The fixed charges for nine months, ending March 31, 1898, were $436,225, leaving a surplus of $47,333.

ELECTRICAL HEATER FOR OIL WELLS.—A successful test has been made at Bruin, Pa., of an electrical heater for removing paraffin from oil wells. In many wells the casing after a time becomes so clogged with paraffin that the flow of oil is much impeded, and in some cases is entirely stopped. The method formerly adopted for removing this paraffin was that of "shooting" the wells with a dynamite cartridge. The new method, which is said to have been devised by Mr. Frank Flannegan, of Washington, D. C., consists in the introduction into the well of an electrical heater, which melts the paraffin and thus removes the obstruction to the flow of the oil. The electrical heater was applied to three wells at Bruin which had been producing not more than one barrel each per day, with the result that an increase of production was effected amounting to from three to five barrels per day for each well.

CHICAGO NOTE.

Branch Office of THE ELECTRICAL WORLD
936 Monadnock Building,
CHICAGO, Ill., April 29, 1898.

ON SATURDAY LAST, April 23, the South Side Elevated Railroad, of Chicago, a steam line operating 16 miles of track, placed in operation the Sprague multiple-unit system. The road, as it is now running, has in operation a large number of trains so equipped, running mixed in with its own steam trains on the regular line and on the "loop." The change from steam to electricity is going on rapidly, and the whole road will soon be operated by the Sprague system. The multiple-unit system differs from others, in that the locomotive idea is abandoned. Each car is equipped with motors and what is called the multiple-unit control, and cars are combined in trains of any required length, and are run from either selected end of any car. The change from steam to the Sprague system will be completely made within a few weeks. It is the intention of the road to run at shorter intervals with the new system, and to vary train length from one to five cars, according to traffic demands. Careful estimates made indicate to the managers of the road that they may save not less

than $150,000 per year in operating expenses, independent of any increase in passenger traffic, which may be reasonably expected on account of improved service. This system is the one which was recently adopted for the initial equipment of the Brooklyn Elevated Railroad, which contract was made by President Uhlmann and Chief Engineer Cornell, as a result of their study and inspection of the South Side equipment. It is thought by the advocates of this system and by many engineers who have made a study of it that the Sprague system of multiple-unit control may mark the abandonment of the locomotive for elevated and suburban services, now operated by steam.

St. Louis Notes.

St. Louis, Mo., April 29, 1898.

THE CIRCUIT COURT on Wednesday last removed Charles Green from the receivership of the People's Railroad. It was made on a motion of L. M. Rumsey, representing the third mortgage bondholders. F. B. Brownell, president of the Brownell Car Company, was appointed to succeed him. He will give a bond of $100,000 and succeed Mr. Green immediately.

THE ST. LOUIS COUNTY COURT at Clayton last week granted the St. Louis, Clayton & Creve Cœur Lake Railroad Company a franchise covering rights of way for connecting lines, loops and extensions of the various feeders and branches of the Lindell Railway system in the county, aggregating over 25 miles in length. The life of the franchise is fifty years. The system will be controlled by the Lindell Railway Company.

A LETTER was received by the Mayor early this week, saying that the city must remove its wires from thirty-five poles belonging to the Bell Telephone Company before July 1, or the same will be taken down and laid on the ground. The Bell Company proposes to comply with the law by removing its poles, and it wants the co-operation of the city. The letter was referred to the Board of Public Improvement.

THE CITY COUNCIL of Belleville and the officers of the American Telephone & Telegraph Company have had a conference for the purpose of considering plans for a franchise to allow the telephone company to put in a plant in Belleville. Through a misunderstanding of the motives of the Belleville authorities in delaying the granting of a franchise to the company the latter had arranged to leave Belleville out in the cold so far as its line was concerned. Amicable arrangements will probably be made.

FOUR STREET RAILROAD BILLS embodying franchises of immense value were introduced in the Council last week. The Lindell Company asks for a franchise which includes its downtown loops, the right to transport household supplies and permit the formal consolidation of all the lines now operated under the different names by the Lindell Company. The Suburban wants a franchise to extend its main line to run funeral and ambulance cars, and transport household goods. The St. Louis & Meramec River Company wants to extend its lines, and asks funeral, ambulance and express privileges, similar to those of the Suburban. An association of South Broadway merchants and property holders asks for a belt franchise. All the bills name electricity as the motive power.

Pacific Coast Notes.

San Francisco, Cal., April 23, 1898.

IT IS REPORTED that the money has been secured for financing the Blue Lakes-San Francisco 110-mile electric power transmission project. A good deal of preliminary engineering has been done.

COMMANDANT GREEN, of the Puget Sound Naval Station, Port Orchard, Wash., has sent in his estimate for additional improvements aggregating in cost $108,000. Among the items are: Electric light plant, $9800; establishing telegraphic and telephonic communication, $4000.

THE NORTHERN RAILWAY & IMPROVEMENT COMPANY, Portland, Ore., has become the owner of all property, franchises, etc., of the New Whatcom & Fairhaven (Wash.) Street Railway, absorbing the interest therein of the Thomson-Houston Electric Company. The road will be operated and improved.

THE REGER-ATWATER COMPANY, incorporated, has moved to 548 Mission Street, San Francisco, occupying commodious offices, and having a three-story warehouse. Mr. Reger has had much experience in the electric railway supply business, and he carries the only large stock of mica on the Pacific Coast.

MRS. EMMA SUTRO MERRITT was recently elected president of the Sutro Railroad Company, succeeding O. F. von Rhein, who had been acting as president since Adolph Sutro had been declared incompetent. Mrs. Merritt, as guardian of her father, is the heaviest stockholder in the electric road. A lady manages a street railway in Los Angeles, Cal.

THE EAST SIDE RAILWAY COMPANY, which operates electric railway lines from Portland, Ore., to Oregon City and to Mt. Tabor, is arranging for a reorganization. The company was orgaized by Geo. A. Steel and Jas. Steel, but went into the hands of Receiver Joseph Simon during hard times. Morris & Whitehead are conducting the negotiations for a new management.

THE WASHBURN & MOEN MANUFACTURING COMPANY is running its branch works in San Francisco night and day on rush orders for the United States Government. Large quantities of rubber-covered "torpedo cable" are shipped from the Worcester works in this city, where the steel wire armor covering is applied. The cables are then distributed to various points on the Pacific and Gulf coasts.

ELECTRIC WORK, in connection with torpedoes and mines, is being carried on in the principal harbors of the Pacific Coast. Lieutenant Meyler, U. S. A., has organized a volunteer corps of citizens to assist in installing cables, etc., in San Diego harbor. Captain Fisk, United States engineer, is in charge of the laying of cables to connect the various forts at the mouth of the Columbia River, and of planting torpedoes. The water approaches to this city are now thoroughly protected, and all lighthouse lamps will be put out at a given signal, should hostile vessels appear. A cable to the Farallone Islands, 20 miles off the Golden Gate, has been asked for by State officials to enable suspicious vessels to be reported here. An electric power station may be installed at the Benicia Arsenal shortly.

Canadian Notes.

Ottawa, Ont., April 29, 1898.

IT IS UNDERSTOOD that the Consolidated Electric Light Company, Victoria, B. C., is preparing to utilize the water power at Goldstream for the operation of the electric lighting and railway system. The work will cost upward of $100,000.

THE MONTREAL COTTON COMPANY, Valleyfield, Que., has placed an order with the Canadian General Electric Company for two 600-hp, three-phase generators, to be direct connected to turbines. With its four generators and station apparatus the company claims that it will have one of the most modern power stations in America.

AN ACT to incorporate the British America Light & Power Company has passed the Private Bills Committee of the House. The company is asking for powers to construct and operate telegraph and telephone lines in the Yukon and also to manufacture, sell and dispose of electricity for fuel, light or motive power.

THE LACHINE RAPIDS HYDRAULIC & LAND COMPANY, Montreal, has invited tenders for a new switchboard, to be placed in the sub-station it has lately erected in that city. It has also purchased two 150-kw synchronous motors, which will be used in the old Temple plant, for the purpose of replacing the present steam plant and obtaining power direct from the rapids.

THE HESS METALLIC FURNITURE COMPANY has begun the erection of a large factory at Niagara Falls, Ont., and probably will be the first concern to use electric power developed on the Canadian side for manufacturing purposes. The Carborundum Company, one of the largest users of electric power on the American side, it is said, is about to close a deal for a building site near the former company, and will commence building before June 1.

THE CATARACT POWER COMPANY has made a proposition to pump the water supply of the city of Hamilton, Ont., by electric power. It agrees to erect at the beach pumping house electric motors and revolving screw pumps of sufficient capacity to pump 10,000,000 gallons per day, and to erect at the high level pumping house motors and pumps and supply sufficient power to pump from the mains to the high level reservoir 2500 gallons per day. The company will keep the pumps in operation for one month, when the city will be expected, if they are satisfactory, to pay for them at the ascertained price, not to exceed $25,000. The price to be paid by the city for electric current necessary for pumping the water required is placed at $13,000 per annum for the first 1,600,000,000 gallons pumped in both reservoirs, and 60 cents for each additional 100,000 gallons. The company claims that its offer will meet the requirements of the fire underwriters and save the city more than $20,000 per year.

English Notes.

(From Our Own Correspondent.)

London, April 20, 1898.

SOURCES OF COMMERCIAL INDIA RUBBER.—Dr. D. Morris, C. M. G., is delivering two lectures at the Society of Arts with the above title, the first having been given on Monday last. After briefly pointing out the dissimilarity between india rubber and gutta percha, and mentioning incidentally that, whereas gutta percha was the juice of one particular plant found only in a limited area in the East Indies, rubber was obtained from several trees spread all over the tropical regions of the world, the lecturer gave a few historical notes. The material was first discovered by Europeans during Columbus' second voyage, the discoverer noticing that the natives of Hayti used balls of this elastic material for much the same purpose as our children do nowadays. It took a great time for the material to be introduced commercially into Europe, however; even at the end of the eighteenth century half a cubic inch cost as much as 3s., it being regarded merely as a curiosity, and its chief use being for erasing pencil marks. In 1830, 23 tons were imported into the United Kingdom, whereas in 1896 and 1897 about 20,000 tons were imported each year. From statistics given it appears that England and the United States of America are by far the greatest rubber consumers and importers in the world. The lecturer then proceeded to describe the various methods of extracting the gum from the rubber tree, and the methods of coagulating it. He spoke (I believe it is the first time that this has been published) of the coagulating system of Messrs. Howard & Giffen, who use a sort of cream separator in which the juice is rapidly rotated, the caoutchouc rising to the top just as cream does. The use of this process has increased the value of Central American rubber by about 25 per cent. In Para, however, the old method of coagulation by means of smoke is still adhered to. In conclusion, the lecturer showed a most interesting diagram, illustrating the fluctuations in the price of Para rubber from 1897 to the present day. The lowest average price during any year was in 1878, when it cost 1s. 11d. per pound, and the highest in 1883, when it rose to 4s. 4½d. per pound. The average price last year was 3s. 6½d., and at the present moment it is 3s. 11d.

EXTENSION OF THE PARSONS STEAM TURBINE PATENT.—The petition to the Judicial Committee of the Privy Council for an extension of the letters patent, granted on April 23, 1884, to the Hon. Charles Algernon Parsons, for "improvements in rotary motors actuated by elastic fluid pressure and ap-

plicable also as pumps" was heard yesterday, with the result that their lordships recommend Her Majesty to grant an extension of the patent for a term of five years. Their reasons for coming to that decision were not given, but will be stated at a later date. It is very rare, indeed, that an application for prolongation of a patent is granted, for it has to be proved, first, that the invention is of exceptional merit, and, second, that adequate remuneration has not been received by the inventor during the run of the original term of the patent. It will be remembered that an extension of the Hopkinson famous three-wire patent was refused, and also that more recently Messrs. Willans & Robinson failed to get a patent, covering a vital principle of the Willans engine, extended. The last electrical patent for which an extension has been granted was the one taken out by I. A. Timmins, for an improved system of electric railway signaling. Mr. Moulton, Q. C., in a very able speech yesterday, pointed out that so far as the petitioner was aware there was no steam turbine in practical use prior to the date of his patent. No one, at any rate, had worked out the conditions essential to the manufacture of a practical turbine capable of working with an efficiency in any way comparable with that of steam engines of the reciprocating type. Mr. Parsons had spent very great time in making the necessary experiments to complete a long and exhaustive research, and, although he was completely successful, he was met with great difficulties in introducing his invention to engineers and engine builders, who were naturally in favor of the ordinary reciprocating type of engine. Lord Kelvin was one of the witnesses in support of the petition. The Parsons steam turbine is already used in a number of electric lighting stations, and in some cases it has displaced high speed reciprocating engines, the vibration of which was objected to by the neighbors of the central stations.

FRENCH NOTES.

(From Our Own Correspondent.)

PARIS, April 21, 1898.

ELECTRIC LIGHTING OF THE RIVER CHARENTE.—An electric lighting plant is about to be installed on the left bank of the River Charente so that merchant vessels can move during the night in the naval port of Rochefort. For this purpose some curious experiments have been conducted of late, about 9 o'clock in the evenings, by a commission presided over by Ship Captain Regnault. Arc lamps arranged en echelon at various heights along the left bank of the river were found to give a sufficient light to permit the navigation of the river at night without fear of mishap. The electric station will probably be placed in the pumping room of the third dry dock of the navy yard at Rochefort. It only remains now for the town to further study the financial side of the question.

METALLIC TISSUE.—MM. Vallot and Pauze, electrical engineers of Saint-Etienne, and proprietors of a paper mill, have just made a new variety of paper that they call "metallized." They add to the paste or cellulose in process of manufacture fine particles of various metals. After passing through the compressing cylinders the metal appears on the surface of the paper as very brilliant grains. Those of tin and aluminum become, after glazing, almost untarnishable, their brilliancy remaining even after exposure to the air for several years. MM. Vallot and Pauze, by thoroughly sprinkling granules of copper and zinc through a specially prepared cellulose obtain a paper that they call "tissu electrique." A bit of this paper, moistened with salt water, contain in a small surface thousands of little voltaic couples, each capable of developing a feeble current of electricity. Applied to the skin the electric paper has therapeutic properties that it would be interesting to analyze.

General News.

NEW INCORPORATIONS.

THE INTERURBAN RAILROAD COMPANY, Des Moines, Ia., has been incorporated with a capital stock of $50,000.

THE TELEPHONE RECEIVER COMPANY, Detroit, Mich., has been formed with a capital stock of $5000.

THE MONTOUR & COLUMBIA TELEPHONE COMPANY, Bloomsburg, Pa., has been formed for the purpose of constructing and leasing telephone lines.

THE PITTSBURG & ALLEGHENY TELEPHONE COMPANY has been incorporated with a capital stock of $1000. The directors are L. H. Matthews and John F. Freeman, of Pittsburg; and John Phelps, of Baltimore.

THE SABETHA TELEPHONE COMPANY, Sabetha, Kan., has been incorporated with a capital stock of $1000. The directors are D. D. Doolittle, G. M. Bunker, Harry Reding, Elizabeth Doolittle, Annie M. Bunker and Helen E. Reding.

THE HARRISON TELEPHONE COMPANY, of Toledo, Ohio, has been incorporated with a capital stock of $100,000. The incorporators are George W. Hull, Harry T. Hull, Lewis Cunningham, D. W. Morris and John P. Manton, all of Toledo.

THE INTERCOLONIAL HYDRAULIC COMPANY, New York City, N. Y., has been incorporated for the purpose of developing, leasing and selling hydraulic and electrical properties. The directors are Henry F. Whalen, Russell H. Landale, Ernest W. Cooke, S. F. Smith, James M. McCarthy, Archibald K. Cook and Charles E. Hathaway. Capital stock, $50,000.

THE GEORGE C. TOWLE MANUFACTURING COMPANY, Lancaster, Pa., has been granted a charter to manufacture electrical machinery in Lancaster, Pa. The directors are G. C. Towle, J. E. Hubley and R. Blickenderfer, Lancaster; George A. Towle, Lowell, Mass., and J. P. Williams, New York. This company has the contract for making the Paragon fan and power motors for the season of 1898.

THE HERKIMER COUNTY LIGHT & POWER COMPANY, Herkimer, N. Y., has been organized with a capital stock of $400,000. This is the name of the company formed by the consolidation of the Herkimer Gaslight Company, of Herkimer; the United Gas & Electric Light Company, of Little Falls, and the Ilion & Mohawk Gas Light Company, of Ilion. The directors are William G. Cochrane, A. B. Cochrane, Yonkers; George E. Weed and others, of New York, and Thomas Ringwood, of Ilion.

THE TELEGRAPH AND TELEPHONE.

ROCHESTER, N. Y.—The Automatic Telephone Company has asked for a franchise in this city.

ARCOLA, ILL.—The Arcola Telephone Company is making preparations to extend its line from Chesterville to Arthur, and from here to Bourbon.

PORTLAND, ORE.—The Inland Telephone & Telegraph Company is making preparations to string a new copper wire between Spokane and this city. The new wire weighs 435 pounds to the mile.

SIOUX CITY, IA.—The Home Telephone Company of this city is arranging to extend its lines from Moville to Pierson, Corrrectionville, Washta and several other towns.

TIFFIN, OHIO.—The Central Construction Company, of Wauseon, is at present engaged in constructing home telephone plants at Bucyrus, Washington, Pa.; Goshen, Ind., and Morenci, Mich.

WOODBINE, IA.—The Woodbine Telephone Company is making active preparations for the extension of its lines. It is intended to construct 50 miles of new line during the summer.

INDIANAPOLIS, IND.—It is stated that the new telephone company will receive a franchise from the city. The company appears to have complied with the specifications of the board in all respects.

BRENHAM, TEX.—Mr. E. C. Laas, of Shelby, Austin County, Tex., is at the head of an enterprise looking to the building of a telephone line from Brenham to Shelby. Nearly all the stock necessary to equip the line has been subscribed.

SAGINAW, MICH.—A new telephone company has been organized at Lansing for the purpose of building a long distance telephone line from that place to Flint. Among the incorporators are Samuel G. Higgins and Frank Marsh.

PONTIAC, MICH.—The Bell Telephone Company is waging the last battle of its war upon the State Telephone Company, and is offering free residence instruments to all its customers who use the Bell apparatus in their places of business.

DES MOINES, IA.—President Hill, of the Mutual Telephone Company, has begun the organization of a telephone toll line to extend from this city to Ottumwa, which will connect thirty-five intermediate towns, including Newton and Oskaloosa.

CONNEAUT, OHIO.—The Conneaut Telephone Company is now connected with all the towns in this county as well as those in Lake County. The line between this place and Ashtabula has been completed, and is now in working order.

DURAND, MICH.—A telephone exchange will be established here, a franchise having been granted by the Council for the purpose. The exchange will be in operation by August 1, and the rates will be $20 for business houses and $15 for residences.

JOPLIN, MO.—The Missouri & Kansas Telephone Company has decided to construct a line from Pittsburg to Chanute. The company will also build a line from Joplin to Sprinfield, Mo. It is its intention to construct a network of telephone lines in Kansas and Missouri.

CHESTER, PA.—The Delaware County Telephone Company has decided to extend its lines to all the boroughs and important towns in the county. The new service, it is expected, will be completed by next year. The company will probably increase its capital stock from $25,000 to $75,000.

MONROE, LA.—A telephone war is on at this place. The Cumberland Telephone & Telegraph Company has made a deep cut in the rates of residence instruments, and is giving all ministers the service free of charge. It is stated that the company has started a war of extermination against the Monroe Telephone Company.

ST. PAUL, MINN.—The application of the American Telephone & Telegraph Company for a franchise in this city seems to have the favor of the Assembly Committee on Streets, which has been considering the ordinance. Final action on the ordinance is expected within the next week or so. The company agrees to construct its lines between St. Paul and Chicago, and to have the service in operation within ninety days after the passage of the ordinance. Before commencing work the company will give a bond to the city in the sum of $5000 to protect the city against suits and damages, and that the company shall fully comply with the conditions of the ordinance.

OELWEIN, IA.—About May 15 the Postal Telegraph Company will install in the Chicago Great Western dynamo room at this place, an engine, dynamo and six motor generators to furnish power for its telegraph service in this district. The engine will be direct connected to a 220-volt dynamo. This will furnish current to six motor generators, three of which will supply current at 200 volts, and the other three at 140 volts, each direct to the telegraph wires through the switchboard in the office of the station. It is stated that this method of operating the wires will effect a saving of about three-fourths of the cost of maintaining batteries.

BUSHNELL, ILL.—Representatives of a number of independent telephone lines met in this city a few days ago and perfected a permanent organization. They represented the Missouri lines, the Hubinger lines of Iowa, Mason County, Fulton County and Henderson County lines, and some other projected lines. An organization was effected, and the following named gentlemen were

elected officers: President, C. O. Pike, Pittsfield; vice-president, J. M. Entwistle, Havana; secretary, E. B. Campbell, of Stronghurst. The object of the organization is to secure a uniform system of construction and to fix a uniform system of toll rates. The name decided on for the new organization is the Interstate Telephone Association. There are about 250 stations on the toll lines represented in the association.

ELECTRIC LIGHT AND POWER.

DETROIT, MICH.—Rogers City is to have electric lighting, a franchise having been granted.

BOZEMAN, MONT.—The power plant of the White Sulphur Springs Electric Light Company has been destroyed by fire.

READING, PA.—The Reading Company's electric plant is to be enlarged, The power house will be extended and an incandescent plant added.

KALAMAZOO, MICH.—Charlotte has been in absolute darkness since February 1 last, due to a tiff with the electric light company.

LANCASTER, WIS.—Contractors are putting in an 80-hp engine and a 1000-light dynamo for the Lancaster Electric Light plant.

McGREGOR, IA.—The electric light company has begun work for the accommodation of its new 2000-light dynamo and 125-hp Corliss engine.

GLENS FALLS, N. Y.—The Board of Trustees has called a special meeting to consider the granting of an electric light franchise to J. E. Derrick.

DETROIT, MICH.—Judge Wisner has granted an order authorizing the sale of the Fenton electric light plant to F. L. Thompson, of Lansing, for $7000.

ST. PAUL, MINN.—The Common Council has voted to alter and enlarge the electric lighting plant. The improvement will cost $20,000. The more economically disposed citizens are opposed to it.

BEARDSTOWN, ILL.—The Beardstown Electric Light & Power Company has authorized the purchase of proposed additions to the plant at a cost of over $7000. A new engine and dynamos are included.

CRYSTAL SPRINGS, MISS.—Mr. Walter G. Kirkpatrick, Jackson, Miss., is preparing plans and the Board of Aldermen is negotiating bonds for the construction of water works and an electric light plant. Hon. P. Moody is Mayor.

SPOKANE, WASH.—A dispatch from Ymir, B. C., says that the Ymir, Dundee & Tamarack and the Porto Rico mine, owned by the Canadian Pacific, will be operated by electric power, and for that purpose a large electric light plant will be built.

BALTIMORE, MD.—The war between the local electric lighting companies still goes merrily on, and the situation is practically unchanged from what it was a month ago. There is no talk of going back to the old rates, and the consumers are rejoicing.

ST. PAUL, MINN.—Judge Fisk has dissolved the temporary injunction brought to restrain the city of Grand Forks, N. Dak., from building and installing an electric light plant for street lighting, and the contractors will proceed to complete the municipal plant at once.

CLARKSVILLE, TENN.—The Queen City Electric Light & Power Company has closed the contract for a 3000-light dynamo, and for a 250-hp Corliss engine, to be delivered by June 1. This will make the capacity of the plant double what it is at present. The company will erect a new building to accommodate the machinery. Work will be begun at once.

BUFFALO, N. Y.—The Albion Electric Light Company has revoked its former bid and made the following proposition to the Board of Trustees: Fifty 2000-cp arc lamps, all dark nights until midnight, five years' contract, $75 per lamp a year; three years' contract, $80 per lamp a year. Until 1 A. M., all dark nights, five years' contract, $82.50 per lamp a year; three years' contract, $87.50 per lamp a year.

WATERBURY, VT.—The Bolton Falls Electric Company has been organized at this place to develop the Bolton Falls, 4½ miles north of here, on the Winooski River. The river at this point falls 46 feet, and it is estimated that it will develop 3000 horse-power. The company is now receiving estimates for installing the water wheels, penstocks, construction of the dam and electrical equipment. The dam is to be made of timber, and is to be 46 feet high and 120 feet long. Plans and information can be secured from Mr. G. H. Almon, Montpelier, Vt. The power is to be used by the Mount Mansfield Electric Railroad, the Vermont State Asylum for the Insane and the lighting of Waterbury, Waterbury Centre, Stowe, Jonesville and Richmond, Vt. The officers of the Bolton Falls Electric Company are: G. E. Moody, president; C. C. Warren, vice-president; C. L. MacMahon, treasurer; G. H. Almon, manager, and C. D. Robinson, clerk.

THE ELECTRIC RAILWAY.

MIDDLETOWN, N. Y.—The building of an electric road from White Lake to Liberty is now under discussion.

SHENANDOAH, PA.—The new trolley line to Ringtown will be built as soon as the survey just made is approved.

BROOKLYN, N. Y.—The Brooklyn Heights Railroad Company has commenced to run through cars to Coney Island from Manhattan, over the bridge.

NEW YORK CITY.—Pelham Manor—The New York, Connecticut & Westchester Traction Company has completed laying its tracks through "No Man's Land," and has abandoned for the present its attempt to cross the New York City line. The fight between this company, which is controlled by the Flynn-Johnson syndicate, of Brooklyn, and the Union Electric Railroad, will undoubtedly be carried into the courts, and the validity of the franchise awarded the Traction Company by the former authorities of Eastchester, prior to annexation, will be tested.

HAVERHILL, MASS.—The Exeter Street Railway will build a casino near the terminus of its line at Hampton Beach this season, hoping to have it ready by July 1.

JOHNSTOWN, PA.—Work on the proposed electric road to connect the Westmoreland towns of Greensburg and Mt. Pleasant, a distance of 12 miles, is to commence soon.

CLEVELAND, OHIO.—Columbus capitalists have a representative at Crystal Spring looking up a route for an electric road between Massillon and Canal Fulton, and ultimately to Akron.

TRENTON, N. J.—The Piscataway Township Committee has been offered $5000 for the franchise for a trolley between Bound Brook and Dunellen. The Lincoln Trolley Company made the offer.

GREENSBORO, N. C.—The city is considering a project to build a street railway and an electric light plant. W. H. Houghton, of New York, has submitted a plan, which is now under consideration.

WORCESTER, MASS.—The Auburn Selectmen have been petitioned by a second company who desire to lay electric railway tracks in that town under the name of the Worcester & Webster Railway Company.

NEWPORT NEWS, VA.—Newport News will have another street railway, the City Council having unanimously granted a franchise to the Newport News, Hampton & Old Point Railway & Electric Company.

BRIDGEPORT, CONN.—The Consolidated road will equip its New Canaan branch with overhead feeder wire instead of the third rail, which was at first contemplated. New 70-pound rails will be laid the entire distance.

BROOKLYN, N. Y.—Huntington people have given their consent to the change of motive power on the local railroad to electricity. This was all that was lacking, and a fine modern trolley will now be put in.

MANCHESTER, N. H.—The town of Hampton has granted a ninety-nine years' lease to a local improvement company, practically the Exeter Electric Railroad, management of the unimproved land at Hampton Beach.

PORTLAND, ME.—The Portland & Yarmouth Electric Railroad has offered the city of Portland $20,000 in twenty-five annual payments, with interest at 5 per cent., and interest on interest, for the privilege of crossing Tukey's bridge.

NEWPORT NEWS, VA.—The material to be used in the construction of the new electric railroad has been ordered. The Town Council of Hampton has given the necessary franchise, and there is every reason to believe Newport News will also.

COLUMBUS, OHIO.—Indications are that Fremont and Tiffin will soon be connected by an electric railroad, and that the line will be extended to Port Clinton and the lake. For some time capitalists have been securing the right of way.

SPRINGFIELD, MASS.—The directors of the Holyoke Street Railway have authorized the issuance of $100,000 of the new stock recently recommended by the stockholders. The machinery at the power house will be increased and other betterments made.

NEWTON, MASS.—The Newton Street Railway has refused the franchise Waltham recently granted it, for a location on Lexington Street to the Waltham line, on account of the onerous conditions imposed. The Waltham Alderman will now offer it to the Lexington Street Railway Company.

NEWBURYPORT, MASS.—The Railroad Commissioners have approved the acquisition of the People's Electric Street Railway, of West Newbury, by the Lowell, Lawrence & Haverhill Company. The board also approved the issue of 5 per cent. bonds by the latter company, amounting to $65,000.

ALTOONA, PA.—A new street railway company will ask Greensburg for a franchise shortly. It is said Congressmen Stone and Dalzell are interested. An $85,000 bridge across the Allegheny River is part of the project. The line is to run to Springdale and Aspinwall, there connecting with the Pittsburg lines.

BUFFALO, N. Y.—The Westinghouse Electric & Manufacturing Company has recently sold to the Niagara Falls Power Company two 500-hp rotary transformers, three 500-kw lowering static transformers, and the complete switchboard, for operating the street railway system of North Tonawanda, N. Y., between Buffalo and Niagara Falls.

SOUTH BETHLEHEM, PA.—The Allentown & Lehigh Valley Traction Company, the Easton, Palmer & Bethlehem Electric Railway Company, and the borough of Bethlehem, seem to be now in accord. The borough gets the "loop" demanded, the traction company is confirmed in its seizure of part of a street, and the Easton Company gets into Bethlehem.

WASHINGTON, D. C.—It is understood that the promoters of the proposed Washington & Baltimore Electrical Railroad have given up the original plans of securing an independent entrance into Washington. Instead, it is alleged the management has secured control of the Georgetown & Tenallytown electric line, and will use that road as the Washington entrance.

BROOKLYN, N. Y.—The Nassau Railroad Company is making improvements that will require four or five weeks to complete, and an outlay of $200,000. Two 1500-hp engines are to be put in at the power house. Two large "boosters" are to be installed. Besides, the tracks are to be extended nearly a mile on Marcy Avenue, and at Coney Island a pavilion will be erected.

SOUTHINGTON, CONN.—The Southington & Plantsville Tramway Company has shut down its trolley road indefinitely. This road, which was the second trolley road to be operated in the State, has been run with the same equipment that was put in in 1888. The rails weigh only 19 pounds to the

yard, and have gotten into such a condition that new equipment is necessary. The management finds that no funds are forthcoming and the shutdown is the result. The company runs a lighting plant, which will be continued for the present.

PERSONAL NOTES.

MR. F. C. PHILLIPS, president of the Elwell-Parker Electric Company of America, Cleveland, Ohio, is in the East on a business trip. He was in New York last Wednesday.

MR. I. FUJIOKA, electrical engineer and manager of the Tokio Electric Light Company, Tokyo, Japan, whose visit to America in 1885 will be remembered, is again in this country. His New York address is 52 East Twenty-first Street.

MR. JOSEPH M. HILL, Western manager of the Bryan-Marsh Company, Chicago, is on a visit to New York, principally on behalf of the Northwestern Electrical Association's convention and lake excursion, in which he has taken so much personal interest.

MR. THOMAS R. MERCEIN, secretary of the Northwestern Electrical Association of Milwaukee is in New York this week, attending the Electrical Exposition and making arrangement for a large attendance of Easterners at the convention and excursion of the Northwestern Electrical Association in June.

MR. LESTER H. WILLIAMS, of Boston, was in New York last week on business. Mr. Williams is a son of Mr. Charles Williams, the well-known pioneer electrical manufacturer, who made a fortune as the first manufacturer of the Bell telephone. Mr. L. H. Williams is identified with the Burton Electric Smelting Company, and also represents one or two different New York houses in Boston.

REMOVAL NOTICES.

MESSRS. PATTISON BROTHERS, electrical contractors and engineers, have moved their offices to 141 Broadway, corner of Liberty Street.

MR. W. S. TURNER has taken an office in the Washington Life Building, 141 Broadway, New York, where he will hereafter be found.

THE ELECTRIC ARC LIGHT COMPANY announces the removal on May 1 of its New York office to 120 Liberty Street, the home of the "Pioneer" enclosed arc.

THE E. G. BERNARD COMPANY, electrical engineer and contractor, has moved its salesrooms from 43 Fourth Street to 450 and 452 Fulton Street, Troy, N. Y. These new salesrooms cover over 6000 square feet, and will afford ample space for the display of the specialties carried by this company.

THE NEW YORK SAFETY STEAM POWER COMPANY has moved to 107 Liberty Street. The company will soon place on the market a new type of horizontal engine, in which there will be embodied many new features in the way of lubrication, etc. The new type of vertical engine recently brought out by the company for both belted and direct connected work is particularly adapted for heavy duty.

THE STANLEY ELECTRIC MANUFACTURING COMPANY, Pittsfield, Mass., has moved its New York offices from 39 Cortlandt Street to the new Empire Building, corner Broadway and Rector Street. The new quarters are more commodious and better adapted to accommodate the conditions of the company's growing business. The new offices are in rooms 1006-1007, and are located on the tenth floor.

MR. GEORGE PATTERSON, Chicago, reports that on or about May 1 the two companies he represents—the American Circular Loom and the Gordon, Law and Phœnix Batteries—will remove from 1114 to 1539 Marquette Building, Chicago, and invites all old friends and customers to come up and have a bird's-eye view of the city. The conduit business was never so good, and is increasing, while the merits of the Phœnix batteries are beginning to be recognized in a very flattering manner.

TRADE AND MISCELLANEOUS PUBLICATIONS.

BENJAMIN F. KELLY & SON, 91 Liberty Street, New York, have issued cards and folders on their Kelly patent improved Berryman water tube feed water heater and purifier, the Economy hot or cold water pump and the Standard feed water heater. All of these devices are illustrated.

THE DEARBORN DRUG & CHEMICAL WORKS, Chicago, Ill., is distributing to the trade two pamphlets treating of the subject of lubrication. This company carries on a business as oil chemist, oil specialist and general chemist in all branches of steam. It also makes vegetable boiler compounds.

CORNELL UNIVERSITY has issued the announcement of courses of instruction in the summer school for teachers and advanced students. The season begins July 5, and continues until August 13. The courses in dynamo laboratory practice, mechanical drawing, elementary designing, kinematic drawing and machine design and laboratory work are open to anyone without entrance requirements, and are valuable to those desiring to advance themselves as draughtsmen, engineers and electricians.

"LIGHTNING ARRESTERS" is the title of a short treatise, from the press of the General Electric Company, descriptive of the devices which it has developed for preventing injury to electric apparatus by lightning. The introduction is a short examination of the qualifications necessary to a perfect lightning arrester, with a short disquisition on the special advantages of the magnetic blow-out. This is followed by concise descriptions of the arc and incandescent station arresters, already well known as types "A," "AA" and "B." Greater space is given to the more recently developed lightning arrester for direct-current circuits up to 850 volts, and to the General Electric short gap arrester, especially designed for alternating-current circuits and in use on many of the great electric power transmissions of the West. The booklet is well written and printed, the illustrations are excellent and the diagrams of connections clear and distinct. A copy of "Lightning Arresters" will be furnished by the supply department of the General Electric Company on application at any of the sales offices.

THE WESTERN ELECTRIC COMPANY has just issued its 1898 catalogue of electric light supplies. This catalogue is probably one of the most complete ever published in the trade, and comprises no less than 555 pages. It is bound in book form, with board back, and is gotten up in every way as carefully as a standard book. Almost every page is illustrated, each illustration being accompanied by a brief description of the apparatus so represented. The term "Electric Light Supplies" embraces a great many articles, and it would be impossible to enumerate them in this case in the space at our disposal. Everything in this line that the Western Electric Company handles is listed in this work. Each article is represented by a designating number to facilitate correspondence, and a telegraph code for the various articles is provided for the same purpose. At the back of the book are given various wire tables and other tabular information of general interest to electricians. The index to code words is very complete, and enables one to tell in a moment what article any code word refers to. An excellent index to headings and materials is also given. Altogether this is one of the most complete and serviceable catalogues ever gotten up by any electrical house.

Trade and Industrial Notes.

THE CORPORATE NAME of the Flashlight & Cyclometer Company, Tilton, N. H., has been changed to Flashlight Sign Company, and will continue the business under that name.

THE ILLINOIS ELECTRIC COMPANY, Chicago, has secured the agency for the Crefeld Electrical Works, Saylesville, R. I. It will represent the Crefeld Company in weatherproof, annunciator, office and magnet wire, and will carry a complete stock of all sizes.

THE BERLIN IRON BRIDGE COMPANY, East Berlin, Conn., has just completed for the Conway Electric Street Railway Company, at Conway, Mass., a steel bridge to carry the electric line across the Deerfield River. This bridge is about 300 feet in length.

THE WARREN ELECTRIC & SPECIALTY COMPANY, Warren, Ohio, has issued a warning to the trade, saying that an incandescent lamp bearing the label of "Warren" is not of its manufacture, and that all its lamps are labeled "The Warren Electric & Specialty Company, Warren, Ohio."

THE ROCHESTER AUTOMATIC LUBRICATOR COMPANY, Rochester, N. Y., has issued a very interesting table of figures, setting forth the fact that in one instance where its lubricators were in use—in the American Tract Society Building, New York City—they effected a saving of 41,200 pounds of coal during five weeks.

MR. PAUL LETHEULE, who is in this country on a scientific mission for the French Government, says he will be glad to receive from American manufacturers and engineers information, reports, pamphlets, etc., relating to electrical engineering likely to assist him in his mission. His address is 24 Front Street, Schenectady, N. Y.

THE STANDARD ELECTRIC CONSTRUCTION COMPANY, 34 North Water Street, Rochester, N. Y., is receiving many flattering recommendations from contractors and supply houses, who use and handle Freeman's Soldering Compound, made by this company. This compound, which is recommended by the National Board of Fire Underwriters, is now in general use.

THE PRISMATIC ELECTRIC SIGN COMPANY, Williamsport, Pa., has received orders and made shipments of signs to the following named places: Pittsburg, Pa.; Brockport, N. Y.; Sandusky, Ohio; Detroit, Mich.; Little Falls, N. Y.; Erie, Pa.; Buffalo, N. Y.; Rochester, N. Y.; Stroudsburg, Pa.; Glenwood Springs, Col.; Atlanta, Ga.; Omaha, Neb.; Syracuse, N. Y, and Ottawa, Canada.

MR. WILLIAM ROCHE, 259 Greenwich Street, New York, extends a cordial invitation to visitors to the Electrical Exhibition to call at his factory at the above address and witness an actual test and demonstration of the merits of his new standard dry batery. These batteries have been before the public but four months, during which time it is stated that over 90,000 cells have been disposed of.

MR. CECIL L. SAUNDERS, who has spent many years in the manufacturing of carbons, and who, it will be remembered, had charge of the practical department of the National Carbon Company, Cleveland, Ohio, has started a factory at North Tonawanda, N. Y., where he will make a brand of high-life carbons, to be known as the "Niagara." Mr. Saunders will shortly place this carbon upon the market.

THE SIGNAL & CONTROL COMPANY has moved its factory from 45-47 York Street, Brooklyn, N. Y., to 24-27 West Street, corner Morris Street, New York. The increasing business of the company necessitated larger quarters, which have been provided at the new place. The company is now in a position to fill orders with promptness and guarantee satisfactory work. Mr. George J. Schoeffel is general manager of the company.

THE NEW VANCOUVER COAL COMPANY, Nanaimo, B. C., has ordered a 175-hp engine from the Ball Engine Company, Erie, Pa., for electric mining purposes. The Chappell Chemical Company, Hegewisch, Ill., will have an electric light plant, which will be driven by a Ball engine, built by the Ball

Engine Company. A 125-hp Ball engine has been ordered by the American Ordnance Company, Lynn, Mass., for Government work.

MESSRS. KOHLER BROTHERS, 1645 Monadnock Block, Chicago, have taken the sales agency for the Northern Electrical Manufacturing Company, Madison, Wis., for the States of Illinois, Iowa, Missouri, Indiana, Nebraska, Kansas, Kentucky, Tennessee, Michigan, Ohio, Pennsylvania, New Jersey, Maryland, Delaware and District of Columbia. They are now prepared to estimate on all kinds of direct current apparatus up to 250 kilowatts.

THE PACKARD MOGUL LAMP is one of the largest successful incandescent lamps made. The trade has settled down quite generally to the 300-cp size, and this is now being used very extensively for lighting where large units are required. It is an interesting fact, says the Electric Appliance Company, of Chicago, that a large number of the first Mogul lamps that were made several years ago are still burning and giving good service.

THE NEWTON APPLIANCE COMPANY, 120 Liberty Street, New York, is meeting with success in introducing the Newton flush switch. Among the buildings in New York City in which these switches have been installed may be mentioned the Astoria Hotel, Columbia University, Delmonico's, the New York Athletic Club, Standard Oil Company Building, Sherry's, the New York City Hall and numerous other residences and office buildings.

THE CENTRAL ELECTRIC COMPANY, Chicago, is introducing a new and very ingenious device for ceiling clusters, consisting of a porcelain block with a metal canopy, which attaches directly to the ceiling, and having the sockets embodied as a component part of the fixture. They are furnished in various sizes from two to five lights, and are specially designed for street car work. Special circulars relating to this device will be sent on application.

MR. J. PIERPONT MORGAN'S yacht "Corsair" has been taken by the United States Government to act as a torpedo destroyer. This yacht has been commented upon everywhere since it was built as a model of construction in every respect. When the contract for equipment was awarded by Mr. Morgan, a complete outfit of the Sprague Electric Company's interior conduit and Lundell direct-connected generating sets was purchased, and it is said that the equipment has never failed to satisfy all demands.

THE SPRAGUE ELECTRIC COMPANY, at its works, 527 West Thirty-fourth Street, New York, is running day and night upon contracts for interior conduit and Lundell power motors for the Government. The interior conduit manufactured by the Sprague Company is said to be the standard of the United States Government, and it is used not only upon a large number of war ships and cruisers, but upon many of the improvised cruisers recently called into service for scouts, torpedo boats and coast defense ships.

MR. THOMAS G. WESTCOTT, general sales agent of the Jersey Electrical Company, Newark, N. J., states that he has recently closed several large contracts for lamps. A special feature of the company's business is the refilling of burned-out lamps, guaranteeing the lamps so renewed to be as good as new ones. The company has completed arrangements to manufacture copper specialties, such as brush springs, commutator brushes, etc., and is, therefore, in the market to offer the highest cash price for scrap copper.

THE CROSS ELECTRICAL COMPANY has opened a suite of offices at 411 Main Street, Buffalo, N. Y. Mr. Fred J. Cross, general manager of the company, is well known among the electrical fraternity, having spent many years as an electrical expert furnishing plans or specifications for the erection of electric lighting and railway plants, not only in this country, but in Canada, as well as other foreign countries. This company, while making a feature of refilling incandescent lamps, will also deal in electrical supplies, beside doing general electrical construction work.

THE WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY has closed a contract for twenty 300-hp two-phase generators, with switchboard and raising transformers, for the San Ildefonso-Tlalnepantla transmission system, near the city of Mexico. The current is to be utilized for lighting and power in the city. The generators are to be direct connected to water wheels. Transmission will be three phase at 22,000 volts. The terms of the contract call for its completion by March 1, 1899. The introduction of so large an installation of American apparatus marks a long step forward in the electrical development of the abundant sources of water power in Mexico.

THE FISCHER FOUNDRY & MACHINE COMPANY, Pittsburg, Pa., writes that the controversy between it and the Weston Engine Company, Painted Post, N. Y., builder of the "Imperial" engine, regarding the infringement of certain patents relating to self-oiling engines, has been decided in favor of the Fischer Company. This decision, the Fischer Company states, affects the majority of builders of self-oiling engines, and will probably result in a decided modification in the existing designs of this type of engine. The Fischer Foundry & Machine Company manufactures the "Fischer" engine.

THE WILHELM TELEPHONE MANUFACTURING COMPANY, Buffalo, N. Y., has removed from its former quarters, Niagara and Franklin Streets, to the new Caxton Building, Division and Ellicott Streets. Here it will have over 6000 square feet of space, which will greatly facilitate the filling or orders. The Wilhelm telephone, although but some eighteen months upon the market, is fast forging to the front. The company is in receipt of several large orders, not only from the United States Government, but also from some of the largest independent telephone exchanges in the country, as well as from others wishing telephones for interior purposes.

THE NEW SOUTHERN TERMINAL railway station at Boston is a good illustration of the scope of the Westinghouse manufactures. The switches and signal system are to be provided by the Union Switch & Signal Company; the engines by the Westinghouse Machine Company; the Westinghouse Air Brake Company will equip the rolling stock, and all the electrical apparatus will be supplied by the Westinghouse Electric & Manufacturing Company. The electric installation is to comprise 1000 horse-power of dynamos and motors. The station when completed will be the finest in the country. Electricity will be used for lighting, for driving pumps, ventilating fans, etc.

THE NEW YORK FINANCE & CONSTRUCTION COMPANY, 141 Broadway, New York, has on hand three Government contracts, namely, the steam and electric plant at Fort Washington, Md.; the engine installation and lighting plant for the Plum Island fortifications, and the complete generating and piping installation in the post office at Pittsburg, Pa. The company is in the market for machinery for these plants. In addition to the contracts named above, the New York Finance & Construction Company has in course of construction at the present time an hydraulic and steam plant for the Government at Fort Hancock, Sandy Hook, N. J.

THE RASTER CARBON RHEOSTAT COMPANY, Chicago, has moved into more spacious quarters, at 807 Ashland Block. Owing to the increased volume of business it has been compelled to make more improvements and enlargements in its factory. It is just completing some very extensive improvements in its manufacturing and testing departments, and is installing some very fine machinery. The marked success with which the resistances are meeting is very gratifying to the company. The company is sending out its circulars R. C. 1 and R. C. 2, illustrating the various forms of resistances. It is now considerably behind on its orders, and is working overtime to catch up.

MESSRS. EUGENE MUNSELL & CO. and the Mica Insulator Company, of New York and Chicago, last week completed arrangements with the George Worthington Company, Cleveland, Ohio, whereby it becomes distributer of both "Mica" and "Micanite." Its territory includes the city of Cleveland and some eight or ten of the adjoining counties. A large stock of India and amber mica, in the sheet and segments for railway motors, as well as "Micanite" plate, segments, rings, cloth, paper, etc., will be carried to supply the electrical trade in that section. This is a step in the right direction, and the trade in Cleveland and vicinity will appreciate the fact that this stock has been placed in the hands of so large a company who has the facilities for making prompt delivery.

RAPID DEVELOPMENT OF THE POLYPHASE SYSTEM.—Within the past three years the Westinghouse Electric & Manufacturing Company has installed over 100,000 horse-power of polyphase generators, ranging in size from 10 to 5000 horse-power each. Judging from the orders at present on hand the Westinghouse Company will build more than 100,000 horse-power of this type of generators alone during the coming year. A single order now on its books calls for 75,000 horse-power. Polyphase motors have also been made in large quantities, ranging from one to 500 horse-power, two of the latter being for the Niagara Falls Electric Light & Power Company, where they are utilized to drive the dynamos for lighting the town, power being supplied to the motors by the 5000-hp Westinghouse Niagara generators.

THE CARLISLE & FINCH COMPANY, Cincinnati, Ohio, states that the searchlight business is coming its way rapidly. Last week it received orders from Boston, New Orleans, Baltimore, San Francisco, Toledo, Chicago and a great many inland towns. For river steamers this company's lamps are said to be recognized as unequaled. The company has lately adopted a special reflector for lamps used on narrow rivers, by means of which the light is spread out in a funnel-shaped ray, illuminating a large area, so that the pilot can see and make landings easily. The 9-inch lamp is especially intended for yachts and launches. It is entirely automatic, and illuminates objects at a distance of half a mile. The new form of pilot house steering gear is very simple, has fewer parts and, it is said, works easier than any type of bevel gear or sprocket chain steering gear, and cannot get out of order.

THE AMERICAN ELECTRIC TELEPHONE COMPANY, Chicago, Ill., recently secured a contract covering apparatus for 3000 instruments for the Saginaw Valley Telephone Company. The Saginaw Company is putting in an underground system at Saginaw, Flint, Bay City and West Bay City. The American Company's apparatus was, we are informed, selected after a very exhaustive test of all apparatus on the market and after the local committees had visited all of the large installations using independent apparatus. The American Electric Telephone Company recently expressed to Seattle a 100-number Express style switchboard complete, and 100 telephones, to be used at Dawson City, N. W. Ter. The apparatus was in competition with the goods manufactured by the American Bell Company, and was sold through the Dominion agents at Montreal and Vancouver. This apparatus was all packed in very narrow boxes, so that it could be placed on sleds and carried through the passes successfully and quickly.

THE C & C ELECTRIC COMPANY, New York, reports being very busy during the month of April. A number of orders came from the Government, and those from other quarters were very numerous. In New York City and vicinity the company sold a large number of small dynamos and motors, and secured an order for two 30-kw direct-connected generators and a 9-hp motor and a three-panel switchboard to be installed at the Grand Union Hotel; an order for three 30-kw direct-connected generators to be installed in the Ward Building, No. 707 Broadway, New York; an order from A. Trenkmann, tortoise shell manufacturer, for a 30-kw belt type generator, and an order from a large wholesale house for a 100-kw direct-connected generator. The company's Pittsburg office, beside making a number of sales of small machines, sent in an order for a 20-kw generator direct connected to the Weston engine, with switchboard, to be installed for the Cambria Brewing Company, Johnstown, Pa; an order for three 30-kw generators to be direct connected to three Weston engines and installed at the custom house and post office at Pittsburg. Mr. J. C. Lucas, the Baltimore representative, secured orders for three 30-kw generators of the direct-connected type to be installed at the Louisville custom house and post office, beside orders for several belt type generators and motors to be installed in Washington and Baltimore. The Philadelphia office sent in its usual large number of orders for machines for Philadelphia and Eastern Pennsylvania, as well as an order from the Government for a complete lighting and power plant for Fort Delaware, consisting of a 100-hp boiler, two 40-hp Ames engines, two 30-kw direct-connected generators, switchboards and booster plant and everything necessary to make a complete power and lighting installation. The Boston office contributed its usual quota. The London representative, Mr. C. R. Heap, sent in orders

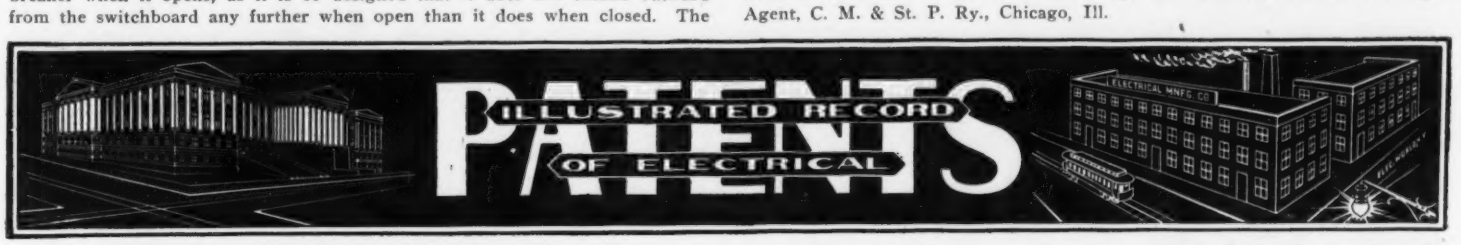
for some ten or twelve ironclad motors. The Chicago representatives, Messrs. Sargent & Lundy, never fail to send in frequent orders, and April was no exception, as their orders covered several good-sized generator and motor equipments.

THE WARD LEONARD ELECTRIC COMPANY, Bronxville, N. Y., is publishing the following reasons why it claims its circuit breaker is the best one: 1. It is the surest to open on overload current, having two independent switches held by independent latches, either of which will open the circuit with a double carbon break. 2. It is impossible to close the circuit breaker when an overload condition exists on the circuit. The two sides being closed independently, the switch first closed always automatically opens the circuit if the first switch be closed upon overload or short circuit. 3. No auxiliary knife switch is required in series with this circuit breaker in order that the operator may safely close the circuit breaker without the risk of being burnt. 4. There is no chance of either switch sticking or failing to open, because, as soon as the latches are released the switch parts receive a strong hammer blow, while the springs are tending to push the switches open. This entirely overcomes the friction of rest under the worst conditions conceivable. 5. There is no chance of the plunger "floating." With the iron clad solenoid magnet the magnetic pull when the plunger engages the latches is much stronger than in other types. The magnetic suction alone without any hammer blow of plunger on latches, will release the latches in our circuit breaker with much less than the minimum current at which it is rated. 6. The friction of the latch is "rolling friction," instead of "sliding friction." The company's 2000-ampere circuit breakers can be readily tripped by hand with a light pressure. 7. These circuit breakers require no auxiliary levers to close them, even in the largest sizes. The division of the work of closing into two parts, and the perfect smoothness of the switch contact, makes it readily possible for any operator to close the largest circuit breakers without effort. 8. There is no chance whatever of the operator or other person being hit by the circuit breaker when it opens, as it is so designed that it does not extend outward from the switchboard any further when open than it does when closed. The maximum distance it extends from the switchboard is about one-half of the distance taken by other makes. 9. Under all conditions there is perfect flexible contact between surfaces absolutely parallel. There is no "wedge action," and it is impossible for one blade to in any way affect the contact of any other blade. 10. The company allows 50 amperes per square inch of switch contact surface in rating the switches. But because of the perfection of contact in its form of switch 75 amperes per square inch causes no more heating than 50 amperes per square inch in the switch of "knife blade" type. 11. A new part can be put into the circuit breaker by any user. No possible accident will make it necessary to return the circuit breaker to the maker. 12. The switch blades are not "sweated in," but can be removed by loosening one nut. In the worst possible case of burning of the switch new switch blades can be sent by mail and inserted in place of the old ones in five minutes after receipt. 13. The circuit breaker can be readily tripped by hand at any time with the greatest ease and with perfect safety. 14. This circuit breaker occupies less room on the switchboard than any other of comparable capacity.

Business Notices.

THE ILLUSTRATIONS in this issue were made by the Photo-Engraving Company, 9-15 Murray Street, New York City.

THE AMERICAN NAVY, CUBA AND HAWAII.—A portfolio, in ten parts, sixteen views in each part, of the finest half-tone pictures of the American Navy, Cuba and Hawaii has just been published, and the Chicago, Milwaukee & St. Paul Railway has made arrangements for a special edition for the benefit of its patrons, and will furnish the full set, 160 pictures, for $1. In view of the present excitement regarding Cuba these pictures are very timely. Send amount with full address to George H. Heafford, General Passenger Agent, C. M. & St. P. Ry., Chicago, Ill.



UNITED STATES PATENTS ISSUED APRIL 26, 1898.

[In charge of Wm. A. Rosenbaum, 177 Times Building, New York.]

602,548. ELECTRIC CONTROLLER FOR GAS REGULATORS; W. E. H. Williams and P. Seiler, San Francisco, Cal. App. filed May 13, 1897. In a gas regulator, the combination of a valve for regulating the pressure, a movable partition actuated by the pressure and connected with the valve to adjust the same and regulate the pressure, a weight opposing the pressure of the gas on said partition, a supplemental weight, an electromagnetic device for removing the supplemental weight, an electric circuit to a distant point energizing the electromagnetic devices, and a switch in the circuit at the distant point, controllable at the will of the operator independently of the gas pressure.

602,895. ELECTRICAL SELECTOR; L. W. Crofoot and F. E. Granger, Aberdeen, S. Dak. App. filed Sept. 14, 1897. In an electrical selecting instrument, a ratchet wheel, impelled by a succession of electrical impulses and provided with means for limiting its movement to one tooth at each electrical impulse, having mounted upon its surface in an eccentrical position a small gear wheel, with a coil spring attached thereto, in combination with a partially toothed gear wheel mounted concentrically with, but revolving independently of, said ratchet wheel, provided with means for being held temporarily in a fixed position, with which the teeth of the small gear wheel will engage as it is being carried around upon the ratchet wheel, said partially toothed gear wheel naving a sufficient number of teeth to wind up the coil spring sufficiently to furnish the power to do the work required.

602,920. ALTERNATING CURRENT INDUCTION MOTOR; C. P. Steinmetz, Schenectady, N. Y. App. filed Feb. 12, 1897. A method of compensating for the self-induction and magnetizing current of an alternating current motor, which consists in inducing from the secondary of the motor leading currents in a tertiary closed circuit in inductive relation to the secondary member.

602,921. ALTERNATING CURRENT INDUCTION MOTOR; C. P. Steinmetz, Schenectady, N. Y. App. filed Feb. 12, 1897. A method of giving starting torque to an alternating current induction motor upon a single-phase circuit, which consists in producing and maintaining leading currents in a closed electric circuit in inductive relation to the primary and secondary circuits of the motor.

602,922. ELECTRIC ARC LAMP; E. Thomson, Swampscott, Mass. App. filed Nov. 4, 1897. The combination with carbon feeding mechanism, of a thermo-electric expansive device, and a series electromagnetic controlling apparatus, responsive to variations in the current passing through the lamp governing the operation of the thermo-electric expansive device.

602,923. TROLLEY; J. E. Wells, Syracuse, N. Y. App. filed May 1, 1897. In an electric trolley, a contact frame comprising sides arching in opposite directions, cross bars connecting them, one side having a longitudinal groove in its upper face or edge, and the other having a rigid longitudinal flange and a rolling contact mounted between said sides, combined with a suitable trolley arm upon which said frame is mounted.

602,925. SYSTEM OF ELECTRIC METERING; H. C. Wirt, Schenectady, N. Y. App. filed Dec. 31, 1897. In a system of electric metering, the combination of circuit mains, a motor mechanism for registering the consumption of energy, and automatic means for varying the damping or retarding effect of the meter.

602,950. ELECTRIC MASSAGE APPLIANCE; F. J. S. Lau, Kansas City, Mo. App. filed July 23, 1897. The combination of a medical battery, a frame supported thereby, a plate therein, a disc, a smooth roller and a fluted roller mounted within the frame, the fluted roller presenting rubber projections, wires extending to the outer ends of the projections and electrically connected to the plate to which one wire from the battery is attached, the other wire being connected to the disc.

602,953. ELECTRIC LUMINOUS ALPHABET AND BOARD FOR SAME; D. M. Moore, Newark, N. J. App. filed Dec. 17, 1895. The combination with the back piece or board, of parallel wires stretched across said board and mounted adjustably thereon, suitable tension devices for said wires, and hollow vacuous receptacles provided with electrodes adapted to enter between the parallel wires for holding said receptacles in place.

602,963. DISTRIBUTION OF ELECTRIC CURRENTS; E. Thomson, Lynn, Mass. App. filed Dec. 6, 1896. The combination of a main or principal circuit carrying rapidly varying electric currents derived from any desired source, induction coils each having a continuous or closed magnetic circuit or core, and whose primaries are connected to the main in multiple arc, translating devices connected in multiple are to the secondary circuit, self-induction coils placed in the multiple branches leading to the primaries of the induction coils, and means for varying the number of coils in which the reaction is set up without short circuiting them.

602,966. VACUUM TUBE LANTERN; L. Wallach, New York, N. Y. App. filed July 20, 1897. A lamp or lantern consisting of parallel heads connected together by a rod, and provided with a series of apertures, electric contacts located at said apertures and concealed within the heads, vacuum tubes fitted to the apertures in said heads and provided with electrodes at their ends for engagement with the said contacts, one electric conductor concete dot the contacts in one head, the other conductor connected to the contacts in the other head, and caps covering the heads, the ends of the tubes and the electrical connection thereto.

603,027. RHEOSTAT; R. W. Ney, New Rochelle, N. Y. App. filed Feb. 5, 1897. A suitable supporting frame, end pieces and two bars which connect the pieces together, a metallic strip secured to the upper end piece, and to which is attached a binding post; and the resistance strips, combined with suitable contact parts to which the ends of the resistance strips are secured, but which contact parts are electrically separated from each other; a binding post and connecting strip connected to the post, and a switch which has its edge to pass under the ends of the contact parts.

603,041. ELECTROSTATIC GENERATING MACHINE; A. H. Hoyt, Penacook, N. H. App. filed Aug. 9, 1897. The combination with the terminals for the working circuit, of spark-gap arms adapted for longitudinal and rotative adjustment within their posts.

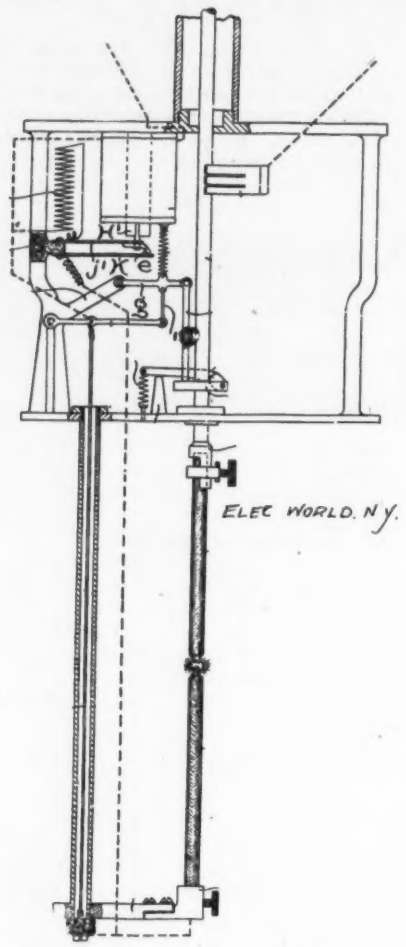
603,042. HINGE CONNECTION FOR ELECTRICAL MEASURING INSTRUMENTS; A. H. Hoyt, Penacook, N. H. App. filed Nov. 1, 1897.

In a thermal registering maximum meter, electrical connections for the stationary and movable parts of the instrument, consisting of flexible metal strips or ribbons.

603,056. INCANDESCENT ELECTRIC LAMP; M. W. Dewey, Syracuse, N. Y. App. filed July 22, 1891. The combination of a light giving electric conductor, a receiver made entirely of glass and completely inclosing said conductor, and from which receiver the air is exhausted, and an electric conductor outside of said receiver and in inductive relation to the inclosed conductor.

603,058. ELECTRICAL RETORT; H. Eldridge, D. J. Clark and S. Blum, Galveston, Tex. App. filed June 28, 1897. In a plant for manufacturing hydrogen gas by electrolysis, a retort having a closed chamber and a conducting bottom, a base insulated electrically from said retort, a closure or head also insulated from the retort, a cathode seated in electrical contact with the conducting bottom of said retort and a packed insulating stuffing box mounted on the head in combination with an anode, electrical connections for the anode and cathode, and means for feeding water to the retort.

603,060. ELECTRIC RAILWAY; C. F. Holtmann and C. Bergmann, Pittsburg, Pa. App. filed Aug. 5, 1897. A series of separated successively ar-



No. 602,922.—Electric Arc Lamp.

ranged contact boxes, a fixed interior metallic contract plate arranged longitudinally within the bottom of each box, and provided at its ends with upwardly disposed contact lugs or projections, a normally spring elevated straight track section arranged longitudinally above each box, each track section being of a U shape in cross section, and carrying a depending connecting post and a horizontal contact bar fitted between its ends to the lower extremity of said connecting posts, and provided with oppositely located pairs of keeper plates adapted to be engaged with said contact lugs or projections.

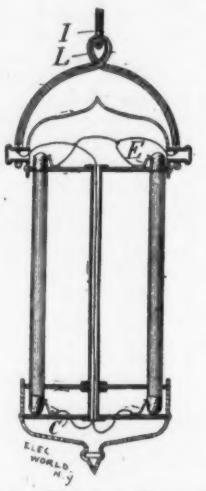
603,063. RHEOSTAT; H. W. Leonard, East Orange, N. J. App. filed July 28, 1896. The combination of a support covered by a layer of partially vitrified insulating material, a layer of vitreous insulating material on said layer, and a conductor held to the insulated side of the support by a layer of non-vitrified insulating material.

603,069. ELECTRIC CABLE; N. H. Warth, Indianapolis, Ind. App. filed Oct. 25, 1897. A device containing compressed insulating gas confined for service as a dielectric.

603,112. ELECTRIC LAMP; D. Misell, New York, N. Y. App. filed Oct. 9, 1897. An electric lamp, comprising a casing, a battery carried thereby, a lamp in connection with one pole of said battery, a conductor extending from said connection to a contact conductor or post exteriorly arranged upon the casing, a handle in connection with the other pole of the battery, and bowed spring plates bearing with relation to the handle and operating to maintain it in either a normal upright position or in a horizontal position in contact with said pin or post, whereby the handle operates to make or break the circuit, and is held in positive position for both purposes.

603,135. ELECTRICAL FOOT GEAR; J. Gallegos, Guatemala, Guatemala. App. filed March 5, 1898. An electrical generator for foot gear, having an insulating insole and a generating insole laid on the insulating insole, the generating insole being formed of a fabric composed of woven strands covered with glass beads.

603,184. ELECTRO-PNEUMATIC PIANO PLAYER; F. R. Goolman, Los Angeles, Cal. App. filed May 5, 1897. In an automatic piano player, an air duct bridge, comprising a block channeled with parallel air ducts, each duct having a lateral opening terminating in an enlarged recess covered by



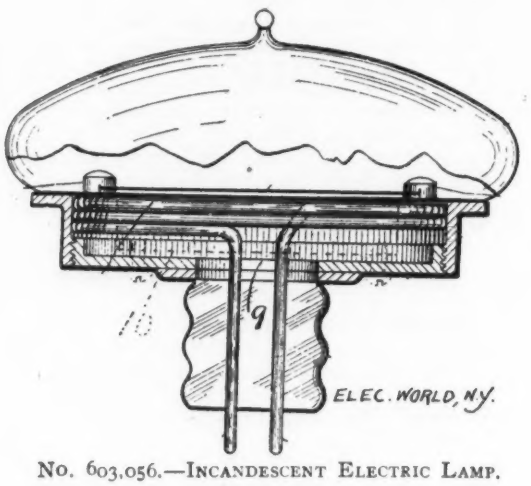
No. 602,966.—Vacuum Tube Lantern.

a flexible diaphragm, and electrical contact points arranged outside the diaphragm, and adapted to be brought into electrical connection by the bulging or lateral movement of the diaphragm from pneumatic action.

603,198. ELECTRICALLY PROPELLED VEHICLE; H. G. Morris and P. G. Salom, Philadelphia, Pa. App. filed Sept. 29, 1896. The combination in an electrically propelled vehicle, of a front axle, motor mounted thereon, a forward structure forming part of the vehicle body, and located directly above the front axle and carrying the battery, a rear axle, a carriage or wagon body trailing from the front structure and mounted upon the rear axle.

603,229. STORAGE BATTERY; E. A. Barber, Watertown, N. Y. App. filed Sept. 13, 1897. In a storage battery, a series of separate and independent superimposed oxidizable metal trays, the electrolytes therein, the asphalt covering for the surfaces of the trays exposed to the electrolyte to prevent the trays from becoming gradually oxidized and destroyed, the positive and negative plates and the electrical connections between each of said plates.

603,230. LINING FOR INTERIOR CONDUITS; S. Bergmann, New York, N. Y. App. filed Nov. 24, 1896. Method of forming conduits for electric wires, which consists in treating a tube made from an absorbent vegetable



No. 603,056.—Incandescent Electric Lamp.

fibre in a bath of fireproof material, then treating it in a bath of drying oil, and finally drying the tube so treated.

603,232. ELECTRIC CLOCK; S. Fischer, New York, N. Y. App. filed June 26, 1897. The combination with the minute hand arbor, of a synchronizing electromagnet, and an arm extending radially from the said arbor and provided at its outer end with an armature adapted to be attracted by said magnet for moving the minute hand forward or backward to a given point of time, so as to synchronize with a master or other clock.